



**United States Military Academy
West Point, New York 10996**

ANNUAL FACULTY RESEARCH REPORT
OF THE
DEPARTMENT OF SYSTEMS ENGINEERING
AND THE
OPERATIONS RESEARCH CENTER
FOR THE
ACADEMIC YEAR 2007

DTIC No. ADA475440

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January 2008

Distribution A: Approved for public release; distribution is unlimited.

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EXECUTIVE SUMMARY

The purpose of this document is to formally summarize and conclude the research program of the *U.S. Military Academy Department of Systems Engineering (DSE) and the Operations Research Center for Excellence (ORCEN)* for the Academic Year 2007. The annual research report includes a statement of purpose for research which supports DSE and the ORCEN, a description of the two organizations, a list of the key personnel responsible for executing the plan, and an overview of the annual research cycle.

After this introduction, we present research summaries for applied research or problem-solving project. Each summary includes a problem statement and description, the methodology employed for project execution, a summary of results, a list of presentations and publications and a current status. Additional information is provided on the senior investigator, principal analyst the client organization, and points of contact.



PART I – THE DEPARTMENT OF SYSTEMS ENGINEERING RESEARCH PROGRAM

Department of Systems Engineering cadets and faculty support leaders for our Army and the Department of Defense by developing innovative solutions to complex national security problems.

The Department of Systems Engineering research projects provide the faculty and cadets with the opportunity to investigate a wide spectrum of interdisciplinary, systemic issues and to apply many of the systems engineering, engineering management, and operations research concepts studied in the classroom to real-world problems of interest to the Army and the Department of Defense (DoD). These projects demonstrate for both cadets and faculty the relevance and importance of systems engineering in today's high-technology military.

The research program in the Department of Systems Engineering (DSE) directly addresses four specific Academy needs:

1. Research enriches cadet education. Cadets learn best when they are challenged and when they are interested. The introduction of current issues facing the military into their curriculum achieves both. Early in their education, cadets are taught by their instructors the application of techniques to real issues and problems – issues and problems they will face upon graduation. Through this, they gain an appreciation of the robustness of the discipline and a greater understanding of their profession. As they progress in their education, they begin to apply these techniques to heretofore unsolved issues and problems. This codifies their education on the techniques and instills an adaptive, problem-solving mentality in the cadets.

2. Research enhances professional development opportunities for Army faculty. It is important to develop and grow as a professional officer in each assignment. On the DSE faculty, officers conduct research on relevant projects to remain current in their operational branch or in the Functional Areas 49, 51, 53 and 57. The research they conduct keeps them abreast of Army and DoD issues, at the forefront of their academic discipline and is returned to the classroom. They become better officers and leaders through the knowledge they gain and impart.

3. Research maintains strong ties between the Academy and Army/DoD agencies. The US Military Academy and DSE is a tremendous source of highly qualified analysts for the Army and DoD. Each faculty member holds an advanced degree in a technical discipline and has a deep understanding of the military and its issues. Research ensures that the Academy remains a significant part of the Army and DoD and not just another source of commissioning for junior officers.

4. Research provides for the integration of new technologies into the academic program. As the pace of technological advances increases, the Academy's education program must not only keep pace but must lead to ensure our graduates and junior officers are prepared for their continued service to the Army. Research which

applies the most advanced technology and techniques is critical to achieving this objective.

5. Research enhances the capabilities of the Army and DoD. The client-based component of the department's research program focuses on challenging problems that these client organizations are struggling to solve with their own resources. In some cases, Academy personnel have key skills and talent that enable solutions to these problems. In other cases, Academy personnel simply add to the effort applied to these problems. In each project, the goal of the research team is to provide value-added deliverables in support of real problems faced by the client. This process supports the other goals of the research program. In particular, cadets gain great confidence in their academic abilities when they can apply those skills in support of Army and DoD clients. This is something they cannot do with pure classroom-based instruction.

6. Research allows publication of significant contributions to academic disciplines. In keeping with good scholarship, the department's research program encourages faculty and cadets to write up the results of their research in applicable journals and conference proceedings. Many faculty and cadets have been successful in this endeavor, allowing the fruits of DSE research to be used by the greater community. This year, our capstone contribution in this area is the publication of our textbook, Decision Making in Systems Engineering and Management, in the Wiley Series in Systems Engineering and Management.

By being fully engaged in current Army and DoD issues, the Department of Systems Engineering and the Operations Research Center assures that systems engineering education at USMA and our faculty remain current and relevant. The military's return on its investment is meaningful career development experiences for officers, especially those in Functional Areas 49, 51, 53, 57, an enhanced education program for the USMA cadets, and important investigation of vital Army and DoD problems at far less cost than would be required through civilian contracts.

The Department of Systems Engineering conducts research through its faculty and the Operations Research Center of Excellence (ORCEN). The department's research coordinator coordinates all aspects of faculty and cadet research, while the ORCEN Director manages those research projects conducted in the ORCEN.

PART II – THE OPERATIONS RESEARCH CENTER OF EXCELLENCE

The purpose of the Operations Research Center of Excellence (ORCEN) is to provide a small, full-time analytical capability to both the Academy and the United States Army and the Department of Defense. The ORCEN was established in 1988 through a Memorandum of Agreement between the Department of Systems Engineering, the Department of Mathematics (DMath) and the Office of the Assistant Secretary of the Army (Financial Management and Comptroller). Its establishment was born of the burgeoning need for developing research opportunities to enrich DSE and DMath education.

Personnel authorizations in the ORCEN are established by a Table of Distribution and Allowances (TDA). Funding support for the Operations Research Center is established by a Memorandum of Agreement with the Office of the Assistant Secretary of the Army (Financial Management). The Operations Research Center is organized under the Office of the Dean as an Academy Center of Excellence. A permanent Military Academy Professor provides oversight and supervision to the Center. In addition, the TDA authorizes one O5 analyst and three O4 analysts. Additional support is provided by a contracted research administrator and a contracted programmer. By agreement between DSE and DMath, DSE provides three analysts, and an Academy Professor as the Director. DMath provides one analyst.

The Operations Research Center was originally sponsored by the Assistant Secretary of the Army (Financial Management & Comptroller). Fully staffed since Academic Year 1990-1991, the Operations Research Center has made significant contributions to cadet education, faculty development, and the Army at large. The following is a list of key personnel from the Operations Research Center for the Academic Year 2007.

Table 1: Key ORCEN Personnel

TITLE & ORGANIZATION	NAME	PHONE (DSN)	EMAIL
Professor and Head, Department of Systems Engineering	COL Timothy E. Trainor, PhD	688-5534	Timothy.Trainor@usa.edu
Professor and Head Department of Mathematical Sciences	COL Michael D. Phillips, PhD	688-5285	Michael.Phillips@usma.edu
Director, ORCEN & Assistant Professor	LTC Simon R. Goerger, PhD	688-5529	Simon.Goerger@usma.edu
Deputy Director, ORCEN & Associate Professor	LTC Dale Henderson, PhD	688-5539	Dale.Henderson@usma.edu
DSE Analyst & Instructor	MAJ Paul Evangelista, PhD	688-4752	Paul.Evangelista@usma.edu
DSE Analyst & Instructor	MAJ Greg Griffin, MS	688-3573	Gregory.Griffin@usma.edu
DSE Analyst & Instructor	MAJ Gary Kramlich, MS	688-5168	Gary.Kramlich@usma.edu
Programmer	Mr. James Cook	688-4473	James.Cook@usma.edu
Administrative Assistant	Ms. Nancy Higgins	688-5897	Nancy.Higgins@usma.edu

PART III – FACULTY RESEARCH

The Department of Systems Engineering encourages its faculty to conduct research of value for the Army and the Department of Defense during their tenure at the United States Military Academy. This specifically includes the rotating junior faculty to support their professional development.

During Academic Year 2007, the Department of Systems Engineering had 18 faculty members holding a PhD and 20 individuals on the faculty holding a Masters Degree. Each holds their advanced degrees in disciplines which support research in systems engineering, engineering management and/or operations research. This is a tremendous research potential for significant clients within the Army and DoD.

The department has a senior faculty member coordinate all faculty research within the department to ensure quality and support of the department's research goals. All research in the Department of Systems Engineering is overseen by a Senior Investigator (SI) to ensure quality and completeness for the client. These Senior Investigators all hold a PhD in a qualified discipline for the research project presented. Most research projects have an associated junior analyst assigned to them. This contributes to the development of the junior analyst as a researcher, the Senior Investigator as a research lead, and provides the client with the best research available by the department.

Table 2: DSE Senior Investigator

NAME	EDUCATION & DEGREE	PHONE (DSN)	EMAIL
COL Timothy E. Trainor	PhD – North Carolina State University - 2001 MBA – Duke University - 1992 BS – USMA – 1983	688-5534	Timothy.Trainor@usma.edu
MAJ Terry Barron	PhD – The University of Georgia - 2000 MS – Troy State University Dothan - 1996 MA – The University of Akron - 1996 BA – Bowling Green State University 1988	688-5536	Terry.Barron@usma.edu
Dr. Roger C. Burk	PhD – University of North Carolina - 1993 MS – Air Force Institute of Technology - 1985 BA – St. John's College - 1974	688-4754	Roger.Burk@usma.edu
MAJ Scott Crino	PhD – University of Virginia - 2006 MS – Texas A & M - 2000 BS – University of Buffalo - 1991	688-2788	Scott.Crino@usma.edu
Dr. Patrick J. Driscoll	PhD – Virginia Tech – 1995 MS – Stanford University – 1989 BS – USMA – 1979	688-6587	Patrick.Driscoll@usma.edu
Dr. Timothy Elkins	PhD – Rutgers University - 2003 MBA – Rutgers University - 1996 BS – Centre College - 1988	688-2707	Timothy.Elkins@usma.edu
MAJ Paul Evangelista	PhD – Rensselaer Polytechnic Institute - 2006 MS – Rensselaer Polytechnic Institute - 2005 BS – USMA – 1996	688-5661	Paul.Evangelista@usma.edu
Dr. Niki C. Goerger	PhD – Texas A&M University – 1992 MS – Mississippi State University – 1988 BS – Mississippi State University – 1986	688-3180	Niki.Goerger@usma.edu
LTC Simon R. Goerger	PhD – Naval Postgraduate School – 2004 MS – Naval Postgraduate School – 1998 BS – USMA – 1988	688-5529	Simon.Goerger@usma.edu
LTC John Halstead	PhD – University of Virginia - 2005 MS – Kansas State University - 1997 BS – USMA - 1986	688-4752	John.Halstead@usma.edu
LTC Dale Henderson	PhD – University of Arizona - 2005 MS – Naval Postgraduate School - 1999 BS – USMA - 1989	688-5539	Dale.Henderson@usma.edu
LTC Robert Kewley	PhD – Rensselaer Polytechnic Institute - 2001 ME – Rensselaer Polytechnic Institute - 1998 BS – USMA – 1988	688-5206	Robert.Kewley@usma.edu
LTC Donna Korycinski	PhD – University of Texas (Austin) - 2003 MSE – University of Texas (Austin) - 1996 BS – Morehead State University - 1986	688-8788	Donna.Korycinski@usma.edu
LTC Michael J. Kwinn, Jr.	PhD – University of Texas (Austin) – 2000 MS – University of Arizona – 1994 BS – USMA – 1984	688-5941	Michael.Kwinn@usma.edu
Dr. Gregory Parnell	PhD – Stanford University – 1985 MS – University of Southern California – 1980 ME – University of Florida – 1974 BS – State University of NY (Buffalo) - 1970	688-4374	Gregory.Parnell@usma.edu
COL Robert Powell	PhD – Stevens Institute of Technology – 2002 MMAS – US Army CGSC – 1999 MS – George Mason University – 1995 BS – Texas A&M University - 1984	688-4311	Robert.Powell@usma.edu
LTC Brian Sperling	PhD – Georgia Institute of Technology – 2005 MS – Air Force Institute of Technology – 1999 BS – USMA - 1989	688-4399	Brian.Sperling@usma.edu
Dr. Paul West	PhD – Stevens Institute of Technology – 2003 MTM – Stevens Institute of Technology – 2000 MBA – Long Island University – 1993 BS – State University of NY (Albany) – 1983	688-5871	Paul.West@usma.edu

Table 3: DSE Analysts

NAME	EDUCATION & DEGREE	PHONE (DSN)	EMAIL
MAJ Gregory Boylan	MS – Georgia Institute of Technology – 2003 BS – USMA – 1994	688-4792	Gregory.Boylan@usma.edu
MAJ Melanie Carlson	MS – University of Virginia – 2006 BS – USMA – 1997	688-3114	Melanie.Carlson@usma.edu
LTC David Dinger	ME – Old Dominion University - 1999 BS – USMA – 1989	688-8006/5525	David.Dinger@usma.edu
MAJ Stephen Gauthier	MS – Naval Postgraduate School – 2006 BS – USMA – 1993	688-6493	Stephen.Gauthier@usma.edu
Mrs. Christina Gelineau	MS – Duke University – 2003 BS – North Carolina State University - 2000	688-5181	Christina.Gelineau@usma.edu
MAJ Kennon Gilliam	MS – Georgia Tech – 2003 BS – USMA – 1994	688-2703	Kennon.Gilliam@usma.edu
MAJ Gregory Griffin	MS – University of Virginia – 2005 BS – USMA – 1994	688-3573	Gregory.Griffin@usma.edu
MAJ Guy Huntsinger	MS – Texas A&M University – 2006 BS – USMA - 1997	688-4857	Guy.Huntsinger@usma.edu
MAJ Chad Jagmin	MSE – University of Michigan - 2003 MS – UMR – Rolla - 1998 BS – USMA – 1994	688-2746	Chad.Jagmin@usma.edu
MAJ Gary Kramlich	MS – Naval Postgraduate School – 2005 BS – USMA – 1996	688-5168	Gary.Kramlich@usma.edu
MAJ Travis (TJ) Lindberg	MS – University of Arizona – 2004 BS – USMA – 1995	688-4311	Travis.Lindberg@usma.edu
MAJ Grant Martin	MS – Georgia Institute of Technology – 2003 BS – USMA – 1994	688-5663	Grant.Martin@usma.edu
LTC Daniel McCarthy	ME – University of Virginia - 1999 BS – USMA – 1990	688-4893	Daniel.McCarthy@usma.edu
COL Kent Miller	MS – Georgia Institute of Technology – 1994 BS – USMA – 1984	688-5578	Kent.Miller@usma.edu
MAJ Michael Rainey	MS – University of Texas - 2006 BS – USMA – 1997	688-2668	Michael.Rainey@usma.edu
MAJ Thomas Rippert	MS – University of Texas (Austin) – 2003 BS – USMA – 1993	688-2510	Thomas.Rippert@usma.edu
LTC Rodney Roederer	MS – Colorado School of Mines - 1996 BS – USMA – 1987	688-4753	Rodney.Roederer@usma.edu
MAJ Edward Teague	MS – University of Texas – 2006 BS – USMA – 1995	688-7705	Edward.Teague@usma.edu
LTC John Willis	MS – University of Virginia - 1999 BS – University of Virginia - 1989	688-4888	John.Willis@usma.edu
MAJ Ernest Wong	MS – Stanford University – 2004 MA – Stanford University – 2004 BS – USMA – 1994	688-4756	Ernest.Wong@usma.edu

PART IV – THE DEPARTMENT RESEARCH CYCLE

Regardless of the research thrust, the research source or the client, each research proposal must be approved by Department Head. The Department Research Coordinator and the ORCEN Director collect potential project proposals from faculty and cadet capstone directors for approval. This development of research opportunities is normally conducted in the summer so that research projects can begin with the start of the academic year.

The Research Cycle for an Academic Year for the Department of Systems Engineering is illustrated in Figure 1. This is a depiction of the objective annual research cycle, which involves several processes in executing the research plan. Among them is the development of research opportunities, the approval timelines and the completion times for each project. Research opportunities can be developed during the academic year, or off-cycle. These projects are approved through the Department Research Coordinator and the Department Head.

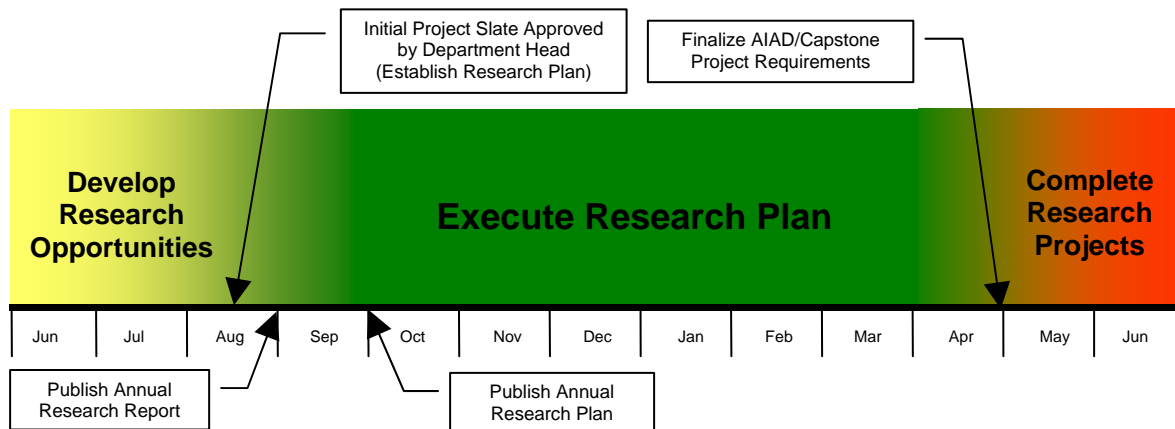


Figure 1: DSE/ORCEN Annual Research Cycle

The Department and the Operations Research Center do not solicit nor conduct many “short turnaround” research projects. The reason for this goes back to the initial objectives of the Department’s research program, which is to support the development of the junior analysts. In the ORCEN, the analysts rotate each year in the June timeframe. To ensure their time is used efficiently and they develop as a researcher, most projects are year-long works.

PART V – Principal Faculty Research Activities – Academic Year 2007

Small Arms Weapon Effective Life

DSE Project No: DSE-R-0625

Client Organization: Program Executive Office (PEO) Soldier Programs

Principal Investigator: MAJ Gary R. Kramlich, MS

Senior Investigator: LTC Simon R. Goerger, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
Mr. Mike Friedman		(973) 724-4368 DSN 880-4368	mfriedma@pica.army.mil
Mr. Charlie Tamez	PEO Soldier 5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	(703) 704-4073 DSN 654-4073	Charlie.tamez@us.army.mil

Problem Description:

As with other equipment, small arms (5.56mm to 40mm) weapons systems for the US Army undergo extensive wear and tear. Traditionally larger weapons systems and machinery are replaced based on a myriad of means to determine the level of use or wear of the mechanisms. However, small arms weapons systems do not have the same level or type of tracking systems as larger, less numerous systems. With the more extensive use of small arms weapons systems since the turn of the century, the need to determine an "effective life" in years, rather than rounds, for weapon systems has become readily apparent and essential for maintaining operational readiness of all personnel. Units need an "effective factor" based upon their historical weapons use - the same way ammunition is allocated by unit type on the STRAC tables to help them determine when they need to be replacing their systems. The Army needs an effective means of forecasting when replacement systems will be required by units in order to have appropriate levels of replacement systems in the inventory ready for use.

Army Material Command is looking for a holistic approach to conditions based maintenance (CBM) for small arms weapons (pistols to MK-19 grenade launchers). The overall methodologies examined and recommended would be those that best fit the needs of the Army. Types of units, number and type of operational deployments, areas/regions of utilization, etc. are some of the factors which should be considered. Currently, the Squad Automatic Weapon (SAW) is one of the weapons of greatest interest.

Proposed Work:

Tasks to be performed and issues to address:

- Define Problem – Small Arms (5.56mm to 40mm) Weapon Effective Life
 - Scope problem with client in terms of options for small arms weapon effective life methodology with regards to users, maintenance personnel, supply chain, and manufacturing for the Squad Automatic Weapon (SAW).
 - Develop focus and brainstorming questions for needs analysis sessions
 - Identify stakeholders and conduct needs analysis to capture ideas and issues for possible SAW Effective Life Methodologies
 - Identify existing and developing SAW users, maintenance personnel, supply chain, and manufacturing organizations
- Conduct Design and Analysis of Alternatives with Stakeholders
 - Host stakeholder analysis and functional decomposition session(s) with focus and brainstorming questions
 - Identify essential elements of use, maintenance, supply, and manufacturing of SAWs which make their life expectancy unique
 - Develop several alternatives to SAW Effective Life Methodologies and CBM options
 - Frame alternatives, based on stakeholder priorities, for presentation to those stakeholders
- Recommend and Select Alternatives
 - Prioritize alternatives/elements, based on stakeholder input and a consideration of future requirements
 - Develop recommendations and present to clients and stakeholders
- Implementation
 - Follow-on work for future funding: 1) Conduct case study to assess the effectiveness of SAW Effective Life Methodologies and CBM options and 2) develop effective life methodologies for other small arms (5.56mm to 40mm) weapons systems.

Results Summary:

The study found that a mandatory small arms overhaul policy can provide the required number of weapons to the operational force while reducing the likelihood of small arms failures during combat operations. The recommendation is that TACOM begin tracking time-of-service information on small arms weapons currently available utilizing Unique Item Tracker data structures; using this information to direct the return of weapons judged to be in greatest need of overhaul. Furthermore, this study recommends that Unit Level Logistic System-Ground track small arms weapons individually to provide managers the capability to monitor weapon readiness. Lastly, weapon shot counters offer

a means of providing more precise method of tracking weapon readiness. The Army should investigate this capability for existing and future systems.

Requirements and Milestones:

Table 1. Project Milestones

Milestone	Tentative Dates
Scope problem with client (systems on which to focus)	15 Jun 2006
Request available data on weapon system(s) from appropriate sources (PM-Soldier, units, AMSO)	15 Jul 2006
Develop focus and brainstorming questions for needs analysis	15 Jul 2006
Identify stakeholders for potential usability study	01 Aug 2006
Conduct needs analysis with stakeholders to determine desired capabilities	15 Sep 2006
Conduct needs analysis with stakeholders (group sessions)	15 Oct 2006
Identify essential elements of methodologies and weapon system that makes it unique	28 Oct 2006
Develop several alternatives methodologies	13 Jan 2007
Conduct IPR with client to review current issue and status of research to date	13 Jan 2007
Develop prioritized list of methodologies and potential test units	17 Feb 2007
Conduct Final Briefing with client with recommendations for methodology and possible implementation test cases	15 Mar 2007
Establish possible test units and/or follow-on methodologies	15 Mar 2007
Final tech report on work completed	15 May 2007

Project Deliverables and Due Date:

- Initial Research Team Briefing with Client: On or About 15 June 2006 *Complete*
- Conduct IPR with client to review current issue and status of research to date: 13 January 2007 *Complete*
- Conduct Final Briefing with client with recommendations for methodology and possible implementation test cases: 15 March 2007 *Complete*
- Establish possible test units and/or follow-on methodologies: 15 March 2007 *Complete*
- Final Technical Report: 15 May 2007 *Complete*

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Presented “Predicting Remaining Effective Life of Small Arms Weapons” at 2006 INFORMS Annual Meeting in Pittsburgh, PA, 06 November 2007
- Presented “Predicting Remaining Effective Life of Small Arms Weapons” at 2007 Decision and Risk Analysis Conference hosted by International Center for Decision and Risk Analysis at the University of Texas at Dallas School of Management,

May 21, 2007

Personnel Briefed:

- a. March 20, 2007
 - i) COL Lipsit, Program Manager Soldier Weapons, Picatinny, NJ
- b. March 28, 2007
 - i) BG Brown, Program Executive Officer Soldier, West Point, NY
- c. March 31, 2007
 - i) MG Lanaers, Commander Tank-Automotive & Armament Command, Warren, MI

Status: Final Technical Report sent to client and DTIC, May 31, 2007. *Complete*

Shaping Insurgent Behaviors on the Battlefield: VBIED Detection and Defeat through Insights into Insurgent Decisioning and Response to Traffic Flow Strategies

DSE Project No: DSE-R-0627

Client Organization: US Army Engineer Research and Development Center (ERDC)

Principal Investigator(s): MAJ Gregory C. Griffin, MS
Paul W. Richmond, PHD, ERDC

Senior Investigator(s): Niki C. Goerger, PhD
LTC Simon R. Goerger, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
Dr. Robert E. Davis	Technical Director US Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory 72 Lyme Road Hanover, New Hampshire 03755-1290	(603) 646-4219	robert.e.davis@erdcl.usace.arm.mil

Problem Description:

Insurgents have effectively employed asymmetric tactics, such as the use of vehicle-borne improvised explosive devices (VBIEDs), as viable threats in urban environments. VBIEDs are often devastating in their physical and emotional effects. They are hard to detect and have proven difficult to thwart or defeat. They would be easier to thwart or defeat if the political, cultural, and physical environments in which they were implemented were more readily constrainable as in full combat operations. However, in stability and support operations, it is important to allow the nearly free flow of people (noncombatants) and goods through an economically developing or thriving community. Moreover, our limited understanding of human behaviors that drive the insurgents' planning, actions, and reactions, and the insurgents' ability to capitalize on the nature of the urban environment in stability and support operations adds to the complexity and challenges of detecting and defeating this threat. There is a need to increase our understanding of the behavioral aspects, or decision making processes, of threats in the larger context of the physical and cultural environment so that we can provide a means to identify threats by evoking responses or producing recognizable patterns such that we begin to shift the advantage in this contemporary operational environment in our favor.

Proposed Work:

The objective of the overall project which this research supports is to provide insights into insurgent behaviors, or decisioning, given traffic flow/ traffic control point (TCP) strategies, employed by counterinsurgents. The objectives are to: (a) develop realistic vignettes for assessing traffic flow and TCP strategies in urban environments during

stability and reconstruction operations, (b) examine use of artificial electromagnetic (AEM) field theory for route assessment, and (c) assist in data generation and analysis. This project is part of the ERDC basic research program (6.1).

Results Summary:

Vignettes were created and implemented in the Map-Aware Non-Uniform Automata (MANA) agent-based combat model to explore insights into significant factors affecting insurgent (suicide bomber) success against fixed targets in urban environments during stability, support, reconstruction, and transition operations. The insights indicate that traffic control point (TCP) strategy is a highly significant factor, which we control. Further investigation found three factors of the TCP Strategy were the root factors affecting the outcome (open avenues of approach, TCP distribution, and the number of TCPs). Insights also showed there are key suicide vehicle borne improvised explosive device SVBIED characteristics that influence their success. Having awareness of these allows us to adjust the strategies we implement.

Requirements and Milestones:

- Data collection for modeling insurgent behaviors (July 06)
- Extend previous AEM work to plan traffic flow for vignettes (Aug 06)
- Develop 1 to 2 vignettes with excursions (July 06)
- Assist in data generation and analysis (Sep 06)

Project Deliverables and Due Date:

- Data collection for experimental design (Aug 06)
- Results and insights (Oct 06)

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Final Presentation to client, October, 2006
- “Using Agent Based Models to Assess Strategies against Asymmetric Warfare,” LTC Simon R. Goerger, Niki C. Goerger, MAJ Gregory C. Griffin, Paul W. Richmond, and MAJ Paul F. Evangelista. INFORMS Annual Conference, 5-9 November, Pittsburgh, PA.

Personnel Briefed:

- Bert Davis, PhD, Director, U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Lab.

Status: *Complete* – 31 October 2006.

Army - CARES II: Army Force Casualty Assistance Readiness Enhancement System II

DSE Project No: DSE-R-0701A

Client Organization: Army Casualty and Mortuary Affairs (HRC)

Principal Investigator: LTC Dale L. Henderson, PhD
Senior Investigator(s): LTC Brian Sperling, PhD
LTC Simon R. Goerger, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
LTC Robert J. Amico	Army Casualty and Memorial Affairs (HRC) Washington, DC 20310-0200	(703) 325-0070 (DSN: 221)	bob.amico@hoffman.army.mil

Problem Description:

To improve the process for those assigned the duties and responsibilities as a Casualty Assistance Officer (CAO). The overall objective is to make it so the primary next-of-kin (PNOK) of deceased service members and retirees receive accurate, timely, and responsive assistance. Starting in August 2005, the ORCEN began development of an automated tool to assist Army CAOs with processing the required forms for military casualty claims and benefits. Issues identified during the development of Army-CARES Version 1.0 by the Inspector General Study and through Department of Systems Engineering research indicated the need for a more integrated solution that encompassed CAO training, streamlined CAO/CAC procedures, and claims and benefits processing into a complete package for all service components. Additionally, inter-agency coordination issues precluded Army-CARES Version 1.0 from developing into a completely paperless process. To further advance the program and leverage today's technological capabilities, the next phases of the project will address these issues.

Proposed Work:

- 1) Longitudinal study to assess the effectiveness of Armed Forces-CARES. This would be conducted from the introduction of Armed Forces-CARES 1.0 to CAOs. As Armed Forces-CARES progresses to Version 2.0 and potentially Version 3.0, research would continue to track the impact of the program on CAOs, surviving family members, and CAC personnel. While dependent on fielding dates for subsequent versions of the Armed Forces-CARES, the study completion date would be by the end of USMA AY08 (May 2008) with a technical report by 31 September 2008.

Envisioned End-Product: A technical report which will indicate the usefulness of Army-CARES; identify how well it and its associated training elements have helped to stream line the CAO process, reduce errors, enhance tracking processes, and provide surviving family members with better casualty assistance support;

and provide follow-on recommendations to identified issues not within the scope of the statement of work to resolve. An interim report will be generated by 31 May 2007.

Risk: (Low/Medium) Past and current efforts of cadet capstone teams and cadets attending Academic Individual Advanced Development (AIADs) with the Army Casualty and Memorial Affairs (HRC) makes this a very high probability for success.

Estimated Time to Complete: 31 September 2008

- 2) This is the completion of the work for Armed Force Casualty Assistance Readiness Enhancement System I (funding already received) which is modified to include the integration of revised CAO/CAC procedures and additional Army-CARES 1.0 forms processing into a single package.

Envisioned End-Product: An Army process and forms completion software tool called Army-CARES 1.0

Risk: (Low/Medium) Current efforts to work on the development of the product to date, makes this a very high probability for success.

Estimated Time to Complete: 31 December 2006

- 3) Integration of updated CAO/CAC training package, revised CAO/CAC procedures, and Army-CARES 1.0 forms processing into a single package. Transition from Army-CARES 1.0 which is primarily automated document to be fully operable with future CAO/CAC training package(s) currently under development.

Envisioned End-Product: An integrated Army casualty assistance process, training, and forms completion software tool called Army-CARES 2.0

Risk: (Low/Medium) Current efforts to work on the development of the training package and the positive collaboration between these project teams makes this a very high probability for success.

Estimated Time to Complete: 31 May 2007

- 4) Support and Upgrade of Army-CARES to integrate Chaplain availability with in the CAC Location.

Envisioned End-Product: Provide a link with the Office of the Chief of Chaplains, Army, to providing the Army Casualty and Memorial Affairs (HRC) and CACs a list of available Activity Duty, Reserve, and National Guard Chaplains by demonstration in the region for use in casualty notification.

Risk: (Low/Medium) The Army Casualty and Memorial Affairs (HRC) is unable to secure agreements with data sources to gain needed data on Active Duty and/or National Guard officers for the COMFORT model. This model already exists and is being used to track Reserve Chaplains.

Estimated Time to Complete: 31 May 2007

- 5) Integration of Army-CARES Version 3.0 into a paperless version of the product. This requires the cooperation with all associated government agencies to accept

paperless products, and the technology requirements associated with this undertaking.

Envisioned End-Product: A software package that is web-enabled to permit paperless transactions for the processing of all military casualty claims and benefits.

Risk: (Medium/High) Technologically, this is not an issue; however, participating agencies maybe reluctant to accept such electronic documents or legislation may prevent this from occurring.

Estimated Time to Complete: 30 June 2008

- 6) Support and Upgrade of the different Army-CARES versions based on changes to entitlements.

Envisioned End-Product: Integrated changes to entitlements into Army-CARES within thirty days of becoming law.

Risk: (Low) The possibility of issues arising from integrating new entitlements is limited due to the open architecture of the prototype product. Only entitlements placed into law prior to 30 September 2008 will be integrated.

Estimated Time to Complete: 31 December 2008

Results Summary:

This project seeks to improve the process of casualty assistance for the next-of-kin for fallen US Army soldiers. The overall objective is to make it so the primary next-of-kin (PNOK) of deceased service members and retirees receive accurate, timely, and responsive assistance. Starting in August 2005, the ORCEN began development of an automated tool to assist Army CAOs with processing the required forms for military casualty claims and benefits. Issues identified during the development of Armed Forces-CARES Version 1.0 by the Inspector General Study and through Department of Systems Engineering research indicated the need for a more integrated solution that encompassed casualty assistance officer (CAO) training, streamlined procedures, and claims and benefits processing into a complete package for all service components.

This work focused on transitioning the results of last year's work into an executable software tool for case management support at US Army casualty assistance centers (CAC's). The development team built upon the stakeholder and requirements analysis completed last year, along with the prototype software package developed in Microsoft Excel. From these products, they created an executable software tool that runs on a case manager's desktop. This tool interfaces with Department of Defense casualty data sources, stores local case data internally, and enables automated process management and forms completion via a user friendly user interface. This work resulted in the delivery and testing of prototype software for use by the casualty assistance centers, carrying out the administrative details of casualty case management. A follow-on study will focus on the deployment, training, and integration of this software tool and associated processes at local casualty assistance centers and at Army level in the Casualty and Mortuary Affairs Office of Human Resources Command.

Requirements and Milestones:

Milestones:

Table 1. Project Milestones

Milestone	Tentative Dates
Conduct Initial Program Telecon with CAO staff	15 Jun 2006
* Provide Software Package for AF-CARES Beta to HRC and test participants	26 Jun 2006
Develop modifications to initial AF-CARES survey for base line study.	01 Jul 2006
* Conduct In-Progress Review Briefing (AF-CARES Beta) with HRC	01 Aug 2006
* Provide Software Package for AF-CARES 1.0 to HRC	21 Aug 2006
Develop initial AF-CARES Version 1.0 survey for longitude study.	01 Sep 2006
* Conduct AF-CARES 1.0 Usability Study	15 Sep 2006
* Conduct Final Briefing with HRC on AF_CARES 1.0	15 Nov 2006
Develop initial AF-CARES Version 2.0 survey for longitude study.	01 Dec 2006
* Provide Software Development Package for AF-CARES 1.0 to HRC	31 Dec 2006
* Provide Technical Report for AF-CARES 1.0 to HRC	31 Dec 2006
Provide Software Package for AF-CARES 2.0 Beta to HRC and test participants	01 Jan 2007
Launch AF-CARES Version 2.0 survey for longitude study.	01 Jan 2007
Conduct In-Progress Review Briefing (AF-CARES 2.0 Beta) with HRC	01 Mar 2007
Longitudinal Study Interim In-Progress Review Briefing	31 Apr 2008
Longitudinal Study Interim Report	31 May 2007
Provide Software Package for AF-CARES 2.0 to HRC	31 May 2007
Provide link to Office of the Chief of Chaplains, Army COMFORT Model	31 May 2007
Provide Technical Report for AF-CARES 2.0 to HRC	31 July 2007
Develop initial AF-CARES Version 3.0 survey for longitude study.	01 Dec 2007
Provide Software Package for AF-CARES 3.0 Beta to HRC and test participants	01 Jan 2008
Launch AF-CARES Version 2.0 survey for longitude study.	01 Jan 2008
Conduct In-Progress Review Briefing (AF-CARES 3.0 Beta) with HRC	01 Mar 2008
Longitudinal Study Final In-Progress Review Briefing	31 May 2008
Provide Software Package for AF-CARES 3.0 to HRC	21 Aug 2008
Longitudinal Study Final Technical Report	31 Sep 2008
Transition Support of AF-CARES to Casualty Assistance Office or designated "host" Organization	31 Dec 2008
Provide Technical Report for AF-CARES 3.0 to HRC	31 Dec 2008

Project Deliverables and Due Date:

- Software Package AF-CARES 2.0 (Beta): 1 January 2007
- In-Progress Review Briefing (Product Implementation Recommendations): 31 April 2008

- Software Package AF-CARES 2.0: 31 May 2007
- Longitudinal Study Interim Report: 31 May 2007
- Link to Office of the Chief of Chaplains, Army COMFORT Model: 31 May 2007
- Technical Report for AF-CARES 2.0: 31 July 2007.
- Software Package AF-CARES 3.0 (Beta): 01 January 2008
- Longitudinal Study Final Report: 31 May 2008
- In-Progress Review Briefing (Product Implementation Recommendations): 31 May 2008
- Software Package AF-CARES 3.0: 21 August 2008
- Final Briefing: 15 December 2008.
- AF-CARES Transition to Host Organization Complete: 31 December 2008.
- Technical Report for AF-CARES 3.0: 31 December 2008.

Presentations and Publications:

In-Progress Reviews and Final Briefing

- DSE Tech Report TR-0619-2
- MECS Conference on Wicked Problems, Peer Reviewed Conference Proceeding, October 07.

Personnel Briefed:

- a. 19 SEP 06
 - i) LTC Bob Amico
 - ii) Mr. Grant Dewey
 - iii) COL Gawkins
 - iv) Various CAC Representatives
- b. 11 OCT 06
 - i) LTC Bob Amico
 - ii) COL Gawkins
- c. 13 DEC 06
 - i) LTC Bob Amico
 - ii) COL Gawkins
- d. 6 APR 07
 - i) Ms. Thompson, Ms Branson (Fort Dix)
 - ii) Mr. Davis, Ms. O'Connor (Fort Meade)
 - iii) Mr. Johnson, CPT Sullivan (Fort Belvoir)

- iv) LTC Bob Amico, HRC
- e. 2 May 07
 - i) Mr. Barber, (Fort Huachuca)

Status:

- Completed testing of initial software, 31 May 2007
- Development and deployment of production software ongoing

Capabilities-Based Design of Future Battle Command Training Centers - Phase II: Model Enhancements and Transition Plan

DSE Project No: DSE-R-0702

**Client Organization: Directorate of Training, Training Simulations Division
(DAMO-TRS)**

Principal Investigator: MAJ Gregory Boylan, MS
Senior Investigator: LTC Simon R. Goerger, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
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Problem Description:

The Army's Transformation to Future Force and the enabling of the Future Combat System (FCS) require the ability to support battle command and embedded training with models and simulations (M&S). Current installation simulation training facilities have been developed over the decades in a manner which maximized their capabilities based on resources, technology, installation requirements, and expertise available at the time the center was built. This has created unique facilities which are non-standard across the Army making and make it more difficult to interoperate. With Network-Centric Warfare being the road to future inter- and intra- service operations, the ability to quickly modify training facilities and interoperate with other facilities in a timely manner is imperative.

From August 2005 until May 2006, The Operations Research Center (ORCEN) at the United States Military Academy performed a study for the Battle Command, Simulation & Experimentation Directorate (BCSE) which attempted to address a series of issues. The driving issues was the fact that current battle command training center facilities (BCTC) facilities were developed and implemented over the last decade to accommodate the unique training needs of specific "digitized" brigade-sized elements at certain installations (namely AWE and Stryker units) and that these facilities were sized and tailored based on the numbers of these types of units at various installations (typically one brigade). Since their construction, the Army has altered its direction, deciding to digitize the entire force. As a result, concerns have arisen about whether existing facilities can accommodate the evolving and growing training needs of the transforming force. Furthermore, how does the Army determine what BCTC facilities need to look like in order to meet these needs for the foreseeable future? In an attempt to address these issues, a BCTC Working Group of subject matter experts was formed. The developed a series of criteria for new BCTCs to be constructed over the next five to fifteen years. However, prior to the work conducted by the ORCEN on *Capabilities-based Design of Future Battle Command Training Centers project*, little quantitative analytical rigor had been

applied to verify the answers to such issues and validate design templates for future facilities.

The initial work performed by the ORCEN resulted in numerous contributions to the Army digital training community to include an analytical tool to assist in the design and development of training facilities to ensure they possess the capabilities required of them. The tool has the capability to simulate training event throughput capabilities of a typical facility in order to identify potential impacts on annual training events conducted based on changes made to:

- Space, staff, and resource levels
- Untimely changes to annual scheduling
- Training requirements (particularly increases)
- Installation unit composition (particularly increases)

Additional research is needed to identify other factors which provide a statistically significant impact on the training event throughput capabilities of a typical future facility and possibly specific existing BCTC facilities. Some of these factors could include:

- Future force composition
- Training event structures
- Additional specified and implied staff requirements
- Cost factors (structural, maintenance, personnel, etc...)
- Pulse factors for surge training times on the installation
- Demands of installation units for specific training schedules to meet mission, deployment, and retraining requirements

Other research is needed to identify issues related to spatial positioning of rooms within the facility, event locations, and personnel flow to maximize the efficiency of the facility's layout based on the recommended minimal room and support staff requirements generated from the training event throughput model.

Proposed Work:

For this research, we propose to employ the Systems Decision Process to identify desired staffing and facilities which would enhance inter-installation simulation center interoperability. Doing so will provide the basis for identifying essential infrastructure and personnel required for installation simulation centers.

The first step in this process is assessing current needs of the digital training community when developing a BCTC facility for a specified installation. A concurrent step will be to collect information and valid referent on BCTC facilities and annual training event throughput from key stakeholders/installations in the modeling and simulation and training fields to help identify additional statistically significant factors in the modeling and design of BCTC. These efforts will result in a refined definition and more accurate scope of the problem, and information to be used to enhance and validate the current training event throughput model and simulation. Capturing insights generated through the process will also be critical in linking this project to the efforts of the BCTC Working Group. Based on this information, the ORCEN will make recommendations to the client for possible modifications to this work package to ensure the client's needs are being addressed.

The ORCEN team will also collect information to help generate alternatives and measure to assess alternatives for potential user and maintenance host(s) for the enhanced training event throughput model. Based on this assessment, the team will make recommendations as to the most viable host(s) for the training event throughput model.

The implementation phase will consist of the ORCEN providing a analyst with working knowledge of the training event throughput model to be a member of the BCTC Working Group; and the ORCEN assisting in the transition of the training event throughput model from the ORCEN to the client designated user and maintenance host(s).

Results Summary:

During the first phase of this project, we utilized the Systems Decision Process (SDP) as the overarching approach to addressing the Army's problem. Our efforts resulted in a stochastic simulation model that yields a capabilities-based assessment of large, medium, and small BCTCs. In the second phase of the project, we endeavored to refine the model by enabling it to generate more specific representations of the various installation BCTCs. Specifically, we focused on modifications and enhancements to the spreadsheets that feed the simulation model. These modifications facilitated the development of the unique throughput requirements for each installation. This, in turn, allowed us to generate the installation-specific capability requirements needed to accommodate that throughput using the modified simulation model.

Over the past year we have continued to refine the simulation model, focusing primarily on the Microsoft Excel component that feeds critical staff and training data into the actual simulation model. As it currently stands, this model serves a multi-faceted analytical purpose. The following points summarize the key capabilities that the simulation model provides:

- 1) A simulation tool that underpins assessments of staff and space (capability) requirements with analytical rigor based on operations research principles.
- 2) The ability to optimize staff and space requirements for a specific installation, based on the unit types, densities, and unique training needs of that installation.
- 3) The ability to evaluate staff and space requests against known throughput requirements, which enables decision-makers to identify excess and then refine allocations as necessary.
- 4) The ability to demonstrate the impacts on training when staff and space allocations are reduced, when unit densities and types at an installation change (say, due to BRAC or other Army Transformation events), and when training strategies change and then generate corresponding changes in throughput requirements.

We developed a user's manual in order to provide users with a reference guide to assist with the implementation of the BCTC Capabilities Assessment Model. It essentially describes the functionality, usage, and set-up procedures both for the Excel-based spreadsheets that generate array data for the model and for the simulation model itself.

Requirements and Milestones:

BCTC Working Group Member	June 2006 – May 2007
Scope problem with client (systems on which to focus)	02 August 2006
With assistance from BCSE and FA57s, query existing and developing installation training and analytical simulation facilities for annual training event through put data	23 August 2006
Develop metrics, collect appropriate data and assess statistical significance and viability of appropriate variable(s) and attributes for enhancements to the training event throughput model	13 September 2006
Develop metrics, collect appropriate data and assess viability of appropriate host organizations to use and maintain the training event throughput model for the client	30 September 2006
Prioritize appropriate variable(s) and attributes for enhancements to the training event throughput model	16 October 2006
Integrate appropriate variable(s) and attributes into the training event throughput model for enhancements	30 November 2006
Develop users manual for the training event throughput model	30 November 2006
Develop recommendations and present to clients and stakeholders on appropriate host organizations to use and maintain the training event throughput model	30 November 2006
Transfer training event throughput model to appropriate host organizations for use and maintenance	15 December 2006
Final Briefing with BCSE and Model Host Organization(s)	15 January 2007
Final Technical Report	28 February 2007

Project Deliverables and Due Date:

- Initial Client Meeting: August 2006.
- Interim IPR: September 2006.
- Transition of Model to Host Organization(s): May 2007.
- Final Briefing: May 2007.
- Technical Report: May 2007.
- Users Manual and Final Model: June 2007

Presentations and Publications:**In-Progress Reviews and Final Briefing**

- Boylan, G. L. and Goerger, S. R. 2006, “Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers,” presented at the US/Canadian Operations Research Symposium, Halifax, Nova Scotia, 12 September 2006.

- Boylan, G. L., Goerger, S. R. and Griffin, G. C. (presenter), 2006, “Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers,” presented at the Simulation Interoperability Workshop, Orlando, FL, 13 September 2006.

Personnel Briefed:

- Boylan, G. L., “Final IPR for the Simulation-Based Design of Battle Command Training Centers Project, Phase II,” Presentation to LTC Darran Anderson, HQDA G-3, Final IPR, 17 May 2007.

Status:

The project is complete. Working simulation and user’s manual delivered to the client in June of 2007. Technical report published in June 2007.

Simulation Roadmap for Program Executive Office Soldier

DSE Project No: DSE-R-0704

Client Organization: Program Executive Office (PEO) Soldier

Principal Investigator(s): MAJ Gary R. Kramlich, MS
MAJ Gregory Boylan, MS
MAJ Grant Martin, MS

Senior Investigator(s): LTC Simon R. Goerger, PhD
LTC Dale L. Henderson, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
Mr. Steve Kishok	PEO Soldier 5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	703-704-4073	Steve.Kishok@belvoir.army.mil

Problem Description:

Background: PEO Soldier requires a tactical combat simulation capability for Light Infantry missions at the level of platoon and below with resolution down to the individual Soldier. The simulation capability must accept, as input, scenarios and Soldier tactical mission system (STMS) characteristics. It must model the functions of the Soldier in a tactical environment, and provide, as output, the measures of effectiveness (MoEs) used to evaluate STMS. The simulation(s) will provide the analytical capability to support PEO Soldier decision making.

Given this effective need, during Fiscal Year 2004, the Operations Research Center of Excellence (ORCEN) developed the set of specific characteristics required of such a simulation. After a thorough study of alternatives, we recommended that PEO Soldier pursue the modification of and linkage between Combat^{XXI}, Infantry Warrior Simulation (IWARS), and OneSAF Objective System (OOS) as the alternative that would best meet PEO Soldier needs. PEO Soldier supports our recommendation and has asked ORCEN to begin with the implementation.

Over the course of Fiscal Year 2006, we proceeded forward with the implementation of our recommended course of action. This essentially consisted of a four-phased approach in which we strove to accomplish the following:

- a. **Summer 2004: Stakeholder Analysis and Approval:** Gain Senior Joint and Army stakeholder “buy-in” whereby we worked with PEO Soldier to prepare and conduct executive-level briefings for senior Army and Joint leadership.
- b. **June 2004-May 2005: Planning for Action:** initiation of the implementation phase by establishing a dialogue with PEO Soldier organizations and simulation proponents, refining simulation requirements, estimating implementation lifecycle costs, and building a tentative execution timeline.

- c. **June 2005-May 2006: Execution:** worked to coordinate, mediate, and draft Memoranda of Agreement (MoA) and/or Memoranda of Understanding (MoU) between PEO Soldier and simulation proponent agencies. Additionally, we continued to work the finalization of initial funding requirements, estimates of implementation lifecycle costs, refinement of simulation requirements, and finally to assist with development of product simulation support plans (SSPs).
- d. **June 2005-May 2006: Supervision:** This fourth phase consisted of monitoring all reports, re-solving administrative issues, updating memoranda, and coordinating for and executing the independent assessment of simulation development and capability.

The ORCEN executed each of these four phases over the past two years, in some cases simultaneously. Currently, PEO Soldier has drafted a MoA and circulated it among the simulation proponents. While not yet signed, the simulation proponents have indicated concurrence with the contents and appear ready to proceed.

Discussion:

- a. One priority task for FY07 is the actual signing of the MoA between PEO Soldier and the simulation proponents. This step serves to tie these organizations together and facilitate discussions on how to best proceed in achieving PEO Soldier's M&S objectives. Upon the signing the MOA, all parties will meet and discuss the next steps forward. Moreover, it is through these meetings and discussions that PEO Soldier, in conjunction with the simulation proponents, will be able to assign specific tasks and requirements for each task. Subsequent to and based upon these assignments, participating simulation development teams can further refine cost estimates and allocations.
- b. In determining the specific modeling requirements, PEO Soldier identified an initial set of the highest-priority products that it wished to have modeled. It circulated these among the proponents for estimates on difficulty, a projected timelines for modeling, and cost estimates. Each of the three proponents provided fairly detailed levels of information in addressing each of these areas.
- c. What remains is a thorough refinement of those modeling requirements to fully capture the effects/impacts on Soldier functions. This will require in-depth analysis of the characteristics/attributes of the STMS components being modeled, their basic effects on the Soldier's battlefield functions, and the behavioral representations/adjustments that each model must incorporate. These refinements will enable the simulation proponents to move forward with their respective models.
- d. Subsequent to these activities being set in motion, PEO Soldier can then look next at the set of prioritized products for the modelers to work. This begins the refinement process for a new set of modeling requirements.

Conclusions: The US Soldier deserves the best equipment available in the shortest amount of time. It is PEO Soldier's goal to improve timely and cost-effective fielding of individual Soldier equipment with effective modeling and simulation (M&S). Improving

the linkage between Combat^{XXI}, IWARS, and OOS provides the Army with a powerful set of tools to support PEO Soldier decision making.

Proposed Work:

This year's work focused on creating a working federation of simulations that could demonstrate progress from previous years' work. The endstate objective was to implement a designed scenario that began in COMBAT^{XXI}, passed to IWARS for individual Soldier actions and effects, and return those results back to COMBAT^{XXI} for integration into the larger scenario. This process would take place on the Environmental Runtime Component (ERC) created and provided by the OneSAF simulation team.

Results Summary:

The year produced significant progress in the long term objective of creating a simulation federation that demonstrates the effects of Soldier equipment. For the first time, COMBAT XXI and Infantry Warrior Simulation (IWARS) can run and transfer combat scenario results between the two platforms. Additionally, this now takes place on the same virtual terrain with the use of OneSAF's Environmental Runtime Component. This proof of concept, along with the initial Design of Experiment that ran thirty iterations of six different equipment combinations, displays the future power and potential of the objective federation. The follow in work will concentrate on moving from a file-based integration to a run-time integration of these models using the Department of Defense High Level Architecture for distributed simulation.

Requirements and Milestones:

Chainmail '07 Requirements and Milestones

Milestone	Date
MoA Finalized	8 Sep 06
Initial meeting w/ MoA signatories (method TBD)	NLT 15 Oct 06
Modeling tasks assigned to simulation proponents	30 Oct 06
Program Review	15 Nov 06
Refinement of modeling requirements (AY07 set) complete;	1 Jan 07
Installation and networking of simulations on-site of proposed exercise location to establish platform for Chainmail '07	o/a 15 February 07
Chainmail '07 & Program Review	o/a mid April 07
Identify next set of products with PEO Soldier	o/a mid April 07
Program Review	15 May 07
Refinement of modeling requirements (AY07 set) complete; Modeling tasks assigned to simulation proponents	TBD
Program Review	15 Aug 07
Technical Report Complete	30 Sep 07

Project Deliverables and Due Date:

- Documentation of meetings and progress reports (May 2007)
- Working file-based integration (May 2007)
- Analysis case using file-based integration (May 2007)
- Proposed tasks for FY2008 (May 2007)
- Technical Report (June 2007)
- Final Briefing (June 2007)

Presentations and Publications:

In-Progress Reviews and Final Briefing

IPR to BG R. Mark Brown on 28MAR07

Final Brief to Mr. Kishok on 03MAY07

Brief to BG Brogan, USMC Systems Command, 14JUN07

Status:

Technical report delivered in September 2007. As of July 2007, the work was funded to continue through FY08, with varying degrees of participation from the three simulation agencies. LTC Robert Kewley assumed the role as lead investigator within the ORCEN.

Brigade Combat Team (BCT) Case Studies – Driving Factors/Best Practices Influencing Effectiveness in the C-IED Fight

DSE Project No: DSE-R-0710

Client Organization: Joint Improvised Explosive Device Defeat Organization (JIEDDO)

Principal Investigator: MAJ Paul F. Evangelista, PhD
Senior Investigator(s): Niki C. Goerger, PhD
LTC Dale L. Henderson, PhD
LTC Simon R. Goerger, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
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Problem Description:

The operational environment (OE) in Operation Iraqi Freedom (OIF) resembles a micro-climate that varies extensively over time and space based on numerous and interrelated political, military, social, economic, infrastructure, information (PMESII), physical environment and time factors. There are volumes of disparate data regarding IED events, unit activities, and assessments pertaining to the OE. Extracting useful information and building situational awareness regarding impact of unit activities and influence of factors in the OE on countering the IED threat requires significant investigation, innovative methodologies, and analysis.

Within the context of countering IEDs in this micro-climate, systematic approaches for discovery of (a) what worked in terms of units' activities, (b) factors across the operational environment that drive counter-IED (C-IED) effectiveness, and (c) potential causality are needed. Extracting useful information and building situational awareness (SA) from the volumes of messy and disparate data regarding IED events, unit activities, and assessments pertaining to the operational environment requires significant investigation, innovative methodologies, and careful analysis. Implicit in this is the development of performance metrics associated with what stakeholders' value.

Proposed Work:

The project objectives were to develop systematic approaches for discovering changes and what triggered changes in IED trends, to identify factors across the operational environment that drive counter-IED effectiveness and to investigate potential causality associated with changes in IED trends. The resultant products are, then, findings and insights regarding practices; case studies examining unit practices, operational environment conditions, IED trends, and rationale as to why over time and space; and methodologies for identifying areas of potential change and, thus, for assessment and

tracking. This research effort was constrained to the C-IED fight in OIF and primarily focused on operations from 2005 to 2006.

Results Summary:

- Case studies addressing conditions in the operational environment, unit practices, and improvised explosive device (IED) trends.
- Insights regarding activities and factors influencing effectiveness in countering IEDs.
- Characterization of the operational environment.
- Methods for identifying potential change points in time and space.
- Procedures for extracting useful information and building situational awareness from operational data.

Requirements and Milestones:

- Data immersion, reduction, and cleaning (October 06)
- Initial set of best practices (Dec 06)
- Visual detection survey (February 07)
- Methodology for change point detection (April 07)
- Characterization of operational environment (June 07)
- Case study development (May 07)

Project Deliverables and Due Date:

- Data collection for experimental design (Aug 06)
- Results and insights (Oct 06)

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Military Operations Research Symposium, Annapolis, Maryland, June 2007 (presentation)

Personnel Briefed:

- Mr. Steve Kirin
- GEN Dave Maddox (ret), JIEDDO panel member
- Dr. Seth Bonder, JIEDDO panel member
- Mr. Brian Barr, JIEDDO panel member
- William Porter, Steven Wallner, John Tirrell, Mike Martin, and Michael Ruther, US Army Research Development and Engineering Command, Communications and Electronics Command, Intelligence and Information Warfare Directorate, September, 2007.

Status: *Complete* – 30 September 2007

Analysis of the PEO Soldier Budget Model

DSE Project No: DSE-R-0715

Client Organization: Program Executive Office (PEO) Soldier

Principal Investigator: MAJ Paul F. Evangelista, PhD

Senior Investigator: LTC Dale L. Henderson, PhD

Points of Contact:

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Mr. Larry Haymes	PEO Soldier ATTN: SFAE-SDR 5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	703-704-1699	Larry.Haymes@us.army.mil

Problem Description:

Background: The Program Executive Office (PEO) Soldier defines its purpose as follows: “to develop the best equipment and field it as quickly as possible so that our Soldiers remain second to none in missions that span the full spectrum of military operations”¹. Over the past four years, the annual PEO Soldier budget has more than quadrupled, growing to over \$4 billion. This budget consists of 20% programmed funding and 80% supplemental funding². Supplemental funds provided to PEO Soldier in support of the war on terrorism have enabled extraordinary progress with several PEO Soldier initiatives. The rapid fielding initiative, new Army Combat Uniform (ACU), ground combat helmet, and various weapons advances have all been made possible by supplemental funding. This supplemental funding is a temporary situation. Given the forecasted federal budget challenges, we may expect substantial decreases from current DoD funding levels particularly in the emergency wartime supplemental funding that has fueled recent PEO Soldier successes. This expectation is consistent with recent experience and historical practice.³ Furthermore, lack of programmed funding stymies long term program planning, which is necessary for many of the complex systems that PEO Soldier develops and fields.

Problem Statement: PEO Soldier accurately predicts programming (FY10-15) requirements that support the needs of the Soldier for the future Army force structure and anticipates budget (FY08-09) requirements for deployed forces.

¹ <https://peoSoldier.army.mil/>

² Phone conversation with PEO Soldier office, 12 July 2006. Program funds refer to funds appropriated under the regular annual authorization-appropriation process, whereas supplemental funds refer to funds appropriated under supplemental or emergency appropriations.

³ Steven M. Kosiak, “FY 2007 Request: DoD Budget Continues to Grow, Modest Program Cuts”, Center for Strategic and Budgetary Analysis, February 6, 2006

Proposed Work:

- Background analysis of the scope and history of federal supplemental funding with an emphasis on the PEO Soldier budget
- Analysis that enables PEO Soldier to accurately anticipate the short term needs for deployed Soldiers
- Modeling methodology to accurately predict (for FY2010 - FY2015) program requirements
- Cost-benefit analysis that addresses the trade offs between supplemental and programmed spending

The current budget model for PEO Soldier consists of modest funding during times of peace with supplemental appropriations meeting needs during wartime. An initial goal of this study is to provide the PEO Soldier with an analytical framework for explaining whether, how, and why the current budget model needs to change or remain the same.

Results Summary:

The primary result of work to date is a methodology for creating a capabilities based budget forecast and capabilities based estimate of the impact of unfunded requirements. Current budget analysis primarily relies on acquisition based goals and measures such as the overall acquisition goal (total quantity) and industrial production capacities. The introduced capabilities based methodology measures the impact of fiscal decisions based upon metrics associated with transformed Brigade Combat Teams (BCT's), focusing on procurement budget lines and measuring the number of BCT sets fielded for a specific fiscal plan. Procurement budget lines typically involve one system. It is possible to forecast the state of that system (in terms of the number of BCTs fielded) during a future fiscal year and then measure the number of BCT sets that the current fiscal year plan procures. The unfunded requirement can also be measured this way. This type of analysis provides decision makers with the ability to understand funding levels as a function of transformed BCT capability. Information required to build these capabilities based forecasts include total asset visibility (through databases such as the property book unit supply enhanced (PBUSE) system), transformed BCT tables of organization and equipment (TOE), and procurement plans (primarily from the program objective memorandum (POM)). A discussion of how to synthesize of this information serves as a fundamental contribution of this work.

Requirements and Milestones:

- 1 November 2006: Initial stakeholder analysis and problem definition.
- 31 January 2007: Stakeholder analysis and problem definition complete.
- 20 February 2007: Development of modeling alternatives and impact illustrations of funding strategies.
- 27 March 2007: Modeling approach and impact illustration of funding strategies approved in IPR with PEO Soldier, BG Mark Brown
- 24 May 2007: IPR with client, PEO Soldier BMD, consisting of:
 - Work completed in AY06-AY07
 - Proposed work for AY07-AY08

- Transition briefing with incoming analyst

Project Deliverables and Due Date:

- A technical report detailing problem definition, capabilities based modeling methodology, historical analysis, and decomposition of PEO Soldier budget has been delivered: 1 June 2007

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Presentation to BG R. Mark Brown, PEO Soldier, West Point, NY, April 2007

Status:

AY06-AY07 project completed. This client decided to pursue recommended future work for this project through AY07-AY08 which is ongoing.

Assessment of Supply Chain Management for RFI

DSE Project No: DSE-R-0717

Client Organization: Program Executive Office (PEO) Soldier

Principal Investigator: MAJ Scott T. Crino, PhD
Contributing Investigator: MAJ Gregory C. Griffin, MS
Senior Investigator: LTC Dan J. McCarthy, MS

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
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Problem Description:

Initial OIF and OEF support required the use of a single facility to receive, package and ship Soldier as a System (Saas) Integrated Concept Team (ICT) equipment from the dozens of suppliers across the United States to units in theater. Now that fielding operations have matured, nearly all (97%) fieldings occur at home station with the remaining going into theater. This has severely reduced the need for a single packaging facility/warehouse located on the east coast.

Most business practices in industry now support the use of a *pull system* where vendors ship directly to the customer while management retains visibility of equipment issued and have the ability to sustain in an efficient responsive manner. Obvious benefits include reduced transportation costs, faster delivery times and lower overhead. Additional benefits include a reduced inventory, lower labor costs, reduced stock holding period, more accurate order fulfillment and improved inventory accuracy.

PEO Soldier's Rapid Fielding Initiative (RFI) cannot currently support direct vendor to customer fieldings. This is primarily due to supply chain operations that are not integrated with their suppliers. Specifically, each supplier uses a unique package labeling system, different from the one used at the Middle River packaging facility. Specific items and packages are not tracked until they reach the Middle River facility and new labels are placed on each box.

Proposed Work:

The objective of this project is to present PEO Soldier with an alternative to the current RFI process that utilizes Lean Six Sigma (LLS) methods and the Systems Decision Process (SDP) in an effort to reduce the time, cost, and process overhead (i.e., handling) of equipment fielding. This approach uses key metrics of performance to compare the current RFI process to feasible alternatives that include elements of best business practices being exercised by nearly 30 industry leaders in supply chain management, such as UPS, Dell, and FedEx. A business case study and final presentation with our

recommendations will be delivered to PEO Soldier at the conclusion of the project in the Spring of 2007.

Results Summary:

The study analyzed PEO Soldier's program of fielding individual soldier equipment to units deploying to theater in support of the Global War on Terror. This analysis included location analysis for their staging warehouse, information management, and size distributions. From this analysis we can make four recommendations:

1. There is an annual cost benefit to moving the warehouse from Middle River, MD to Louisville, KY
2. An improved information management system (IMS) will bridge communication gaps and reduce inventory levels. Having a third party who's core competency is in inventory management implement this system will enhance any gains realized by improving the IMS.
3. At this time, instituting a full fledged *Pull* system will not simplify process or reduce operational costs. However, using some of the tools of a Pull system that are incorporated in more advanced IMS will improve efficiency of the whole system.
4. Adjust current tariff by returning the size distribution to a 100% scale, accepting the proposed (updated) size distribution, and recalculating the by-commodity tariff using the objective function with a risk level that reflects your tolerance of stocking out will reduce stocks outs at the fielding sites and reduce the number of returns back to the warehouse thus reducing inventory and shipping costs throughout the system.

The study team delivered size distribution analysis to PEO Soldier and trained their managers to employ proper risk methodologies in the fielding process. PEO Soldier has continued this study in academic year 2007-2008 in order to further assess options with respect to warehousing and information management.

Requirements and Milestones:

Table 1 Project Milestones

Milestone	Tentative Dates
Scope problem with client (systems on which to focus)	28 Sep '06
Request available data on current system from appropriate sources	02 Oct '06
Develop focus and brainstorming questions for needs analysis	27 Oct '06
Identify stakeholders for potential usability study	03 Nov '06
Conduct needs analysis with stakeholders (group sessions)	22 Nov '06
Develop several alternative systems from existing system and other organizations	08 Dec '06
Conduct IPR with client to review current issues, status of research to date, and present alternatives	04 Jan '07
Develop prioritized list of alternatives and implement M&S	16 Feb '07
Conduct Final Briefing with client with the results of the M&S and recommendations for the system.	01 Mar '07

Milestone	Tentative Dates
Final tech report on work completed	01 Apr '07

Project Deliverables and Due Date:

- Initial Research Team Briefing with Client: On or About 07 August 2006
- Conduct IPR with client to review current issue and status of research to date: 23 October 2006
- Conduct Final Briefing with client with recommendations for methodology and possible implementation test cases: 1 April 2007
- Final Technical Report: 21 May 2007

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Crino, S., McCarthy, D. and Carier, J., “Lean Six Sigma as Applied to the Army Rapid Fielding Initiative”. Proceedings of the 1st Annual IEEE Systems Conference, Honolulu, HI, April 9-12, 2007
- “A Case Study of the Army Rapid Fielding Initiative” 16 May 2007

Personnel Briefed:

- f. 16 May 2007
 - i) Mr. Kenneth Wright
 - ii) LTC Hollman
 - iii) MSG Lainhart
 - iv) Mr. Charles Tomez
 - v) Mr. Bruce Dahm
- g. 28 March 2007
 - i) Brigadier General Brown

Status:

Both the final Case Study Report and Presentation were delivered to members of RFI on 16 May 2007 at Fort Belvoir, Virginia.

Shaping Insurgent Behaviors on the Battlefield: VBIED Detection and Defeat through Insights into Insurgent Decisioning and Response to Traffic Flow Strategies - Phase II

DSE Project No: DSE-R-0719

Client Organization: US Army Engineer Research and Development Center (ERDC)

Principal Investigator(s): MAJ Gregory C. Griffin, MS

Paul W. Richmond, PhD, ERDC

Senior Investigator(s): Niki C. Goerger, PhD

LTC Simon R. Goerger, PhD

Points of Contact:

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Problem Description:

Insurgents have effectively employed asymmetric tactics, such as the use of vehicle-borne improvised explosive devices (VBIEDs), as viable threats in urban environments. VBIEDs are often devastating in their physical and emotional effects. They are hard to detect and have proven difficult to thwart or defeat. They would be easier to thwart or defeat if the political, cultural, and physical environments in which they were implemented were more readily constrainable as in full combat operations. However, in stability and support operations, it is important to allow the nearly free flow of people (noncombatants) and goods through an economically developing or thriving community. Moreover, our limited understanding of human behaviors that drive the insurgents' planning, actions, and reactions, and the insurgents' ability to capitalize on the nature of the urban environment in stability and support operations adds to the complexity and challenges of detecting and defeating this threat. There is a need to increase our understanding of the behavioral aspects, or decision making processes, of threats in the larger context of the physical and cultural environment so that we can provide a means to identify threats by evoking responses or producing recognizable patterns such that we begin to shift the advantage in this contemporary operational environment in our favor.

Proposed Work:

The objective of the overall project which this research supports is to provide insights into insurgent behaviors, or decisioning, given traffic flow/ traffic control point (TCP) strategies, employed by counterinsurgents. The objectives are to: (a) develop realistic vignettes for assessing traffic flow and TCP strategies in urban environments during stability and reconstruction operations, (b) examine use of artificial electromagnetic

(AEM) field theory for route assessment, and (c) assist in data generation and analysis. This project is part of the ERDC basic research program (6.1). Goerger et al. conducted the initial study utilizing agent based models to provide insights into countering the suicide bomber threat in urban environments during stability, support, transition, and reconstruction (SSTR) operations. In phase II of this research, we examined effects of the number of and ratio of types of traffic control point (TCPs), the number of targets available to the SVBIEDs, geographic dispersion of TCPs within the area of operations (AO), and a range of SVBIED behaviors on SVBIED mission outcome.

Results Summary:

Scenarios were created and implemented in the Map-Aware Non-Uniform Automata (MANA) agent-based model to explore insights and identify factors needed to create effective traffic control point/traffic flow strategies robust against a range of suicide vehicle borne improvised explosive device (SVBIED) behaviors, preferences, and capabilities to help detect and defeat SVBIEDs or lessen their impact. Artificial electromagnetic field theory was used for route planning prior to execution. Nearly-orthogonal Latin hyper-cubes were selected for the experimental design. This study built upon and extended our previous work through incorporating densified road networks, including multiple targets, and having intended target locations not precisely known by friendly forces. Moreover, the factor selections focused exploring factors that differentiated traffic control point (TCP) strategies.

Findings showed that the TCP strategy factors investigated affected SVBIED mission outcomes. Having awareness of these allows friendly forces to adjust the strategies implemented. Regarding the five factors associated with TCP strategies, we offered the following insights:

- Number of TCPs: More is not always better, particularly if the adversary is bent on destruction using a primary or alternate target that includes TCPs.
- TCP Type Ratio: Prudent employment of TCP type can turn the tables on an adversary's intelligence network by increasing their uncertainty.
- Target List: "Know thy enemy". Decisions regarding TCP emplacement are more likely to be effective when based on analysis and facts.
- TCP Dispersion: The greater the geographical dispersion and coverage across the AO, the more difficult it is for insurgents to find low observable routes. (Caveat with "more is not always better".)
- SVBIED Reaction: As the enemy becomes more aggressive, it is more effective to attack the command and supply network.

Requirements and Milestones:

- Data collection for modeling insurgent behaviors (July 06)
- Extend previous AEM work to plan traffic flow for vignettes (Aug 06)
- Develop 1 to 2 vignettes with excursions (July 06)
- Assist in data generation and analysis (Sep 06)

Project Deliverables and Due Date:

- Data collection for experimental design (Aug 06)
- Results and insights (Oct 06)

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Military Operations Research Symposium, Annapolis, Maryland, June 2007 (presentation)
- “Shaping Insurgent Route Selection: Moving to Area Coverage Strategies,” Niki C. Goerger, LTC Simon R. Goerger, MAJ Gregory C. Griffin, MAJ Edward Teague, Paul W. Richmond. Simulation Interoperability Workshop Proceedings and Presentation, September 2007 (presentation and publication)
- “Shaping Insurgent Route Selection Using Traffic Flow Strategies,” Niki C. Goerger, MAJ Edward Teague, LTC Simon R. Goerger, MAJ Gregory C. Griffin, Paul W. Richmond. Industry/Inter-service Training Simulation and Education Conference Proceedings and Presentation, December 2007 (presentation and publication).

Personnel Briefed:

- Bert Davis, PhD, Director, U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Lab, numerous occasions.
- William Poter, Steven Wallner, John Tirrell, Mike Martin, and Michael Ruther, US Army Research Development and Engineering Command, Communications and Electronics Command, Intelligence and Information Warfare Directorate, September, 2007.
- Delegates from the United States and Canada during the US/Canadian Operations Research Symposium, September 2007.

Status: *Complete* – 30 September 2007.

Temporal System Modeling of Counter-Insurgency Policy Dynamics

DSE Project No: DSE-R-0720

Client Organization: None

Principal Investigator: Patrick Driscoll, PhD

Senior Investigator: Niki C. Goerger, PhD

Points of Contact:

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Problem Description:

The challenge of identifying insurgent force intent and thus structuring effective counter-insurgency strategy is complicated by a host of elements, not the least of which are the lags of time-dependent effects propagated throughout the coupled systems comprising a metropolitan area. When lagged effects are evident, they can be mistakenly attributed to causes observed in the near past or present, thereby confounding effective response planning efforts. To complicate matters further, there is a lurking suspicion remaining that despite the efforts of U.S. forces to strengthen the infrastructure of Iraqi cities, these cities will collapse to an unsatisfactory state once U.S. forces are withdrawn.

Statistical and pattern analysis techniques applied to insurgent incidents are limited in that they neither capture the dynamic and stochastic nature of insurgent behavior itself, nor are capable of leveraging these elements to estimate insurgent intent that contains elements of long term intended effects. Moreover, they completely fail to provide analysts with guidelines against which any data mining efforts should be structured and performed.

Proposed Work:

In this study, we propose a new stochastic modeling approach for informing counter-insurgency strategy at the theater level of operations based on linear dynamic control system theory. This approach is intended to specifically overcome the shortcomings in available methods noted above. Using this approach, we show that any effective counter-insurgency strategy must necessarily capture the linkage between physical layer components and the critical services they provide. Against this structure, incident data takes on a new perspective, one that provides significant insights into the intent of insurgent strategy, yielding significant criteria against which to structure a data-based exploration of insurgent incidents that supports strong inference.

This work is collaborative work with the Defense Science & Technology Laboratory of the United Kingdom. Although an international agreement was identified that could

serve as an authorization document to support information sharing on this project, the collaboration did not come to pass. Consequently, the work summarized in this report reflects only material developed by the Department of Systems Engineering investigators. Interest in the modeling approach has motivated an active collaboration for FY08 with Dr. William Fox, Defense Analysis Department, Naval Postgraduate School.

Results Summary:

In this work, we developed an effects-based, state-dependent discrete dynamic modeling technique for informing counter-insurgency policy planning. The approach propagates effects of both insurgent and counter-insurgent strategies as they play out over time in a competitive fashion on the state condition levels of both physical infrastructure elements and the major services they provide.

To make the approach precise, three definitions were needed in order to describe how an urban area as a system responds to insurgent shocks:

Robustness: the range or span of system shocks and their intensity against which a composite urban system is able to maintain a critical set of infrastructure elements (physical and services), I , above a robustness threshold.

Resiliency: the time it takes to return a critical set, I , of urban system elements to a condition at least as “good as prior to shock” state within normal control bounds after a system shock(s) has degraded them past the composite system’s robustness threshold.

Robustness threshold: the shock level beyond which the composite urban system is no longer able to return a critical set of elements to a condition at least as “good as prior to shock” state within normal control bounds without extraordinary intervention.

The Basic Model with a single shock taking place at time $t = \tau$ (note: time is in discrete increments and represented as t here only for convenience in notation) is given by

$$\begin{bmatrix} x_i(t+1) \\ s_k(t+1) \end{bmatrix} = \begin{bmatrix} Q_{xx} & Q_{xs} \\ Q_{sx} & Q_{ss} \end{bmatrix}^T \begin{bmatrix} x_i(t) \\ s_k(t) \end{bmatrix} + \begin{bmatrix} m_i(t^*) \\ m_k(t^*) \end{bmatrix} + \begin{bmatrix} c_i(\tau) \\ c_k(\tau) \end{bmatrix}$$

where $c(\tau)$ is an insurgent shock effect imposed on an urban state condition at time t . To represent insurgent activity targeting system interdependencies, we modify the model to

$$\begin{bmatrix} x_i(t+1) \\ s_k(t+1) \end{bmatrix} = \begin{bmatrix} \tilde{Q}_{xx} & \tilde{Q}_{xs} \\ \tilde{Q}_{sx} & \tilde{Q}_{ss} \end{bmatrix}^T \begin{bmatrix} x_i(t) \\ s_k(t) \end{bmatrix} + \begin{bmatrix} m_i(t^*) \\ m_k(t^*) \end{bmatrix} + \begin{bmatrix} c_i(\tau) \\ c_k(\tau) \end{bmatrix}$$

where

$$\begin{bmatrix} \tilde{Q}_{xx} & \tilde{Q}_{xs} \\ \tilde{Q}_{sx} & \tilde{Q}_{ss} \end{bmatrix}^T = \left(\begin{bmatrix} Q_{xx} & Q_{xs} \\ Q_{sx} & Q_{ss} \end{bmatrix}^T + \begin{bmatrix} C_{xx}(\tau) & C_{xs}(\tau) \\ C_{sx}(\tau) & C_{ss}(\tau) \end{bmatrix}^T \right)$$

Insurgent shock strategy (non-stochastic) is defined then by triplets

$$\left(\begin{bmatrix} C_{xx}(T) & C_{sx}(T) \\ C_{xs}(T) & C_{ss}(T) \end{bmatrix}, \begin{bmatrix} c_i(T) \\ c_k(T) \end{bmatrix}, T = \{\tau_1, \tau_2, \dots\} \right)$$

Designating a portfolio of planned effects to be imposed on the system state, its interdependencies (linkages), or both over a set of times T .

Recognizing that counter-insurgency strategy consists of two components: response planning and preparedness planning, we model response plans for post shock as a triplet

$$\left(\begin{bmatrix} R_{xx}(\delta) & R_{sx}(\delta) \\ R_{xs}(\delta) & R_{ss}(\delta) \end{bmatrix}, \begin{bmatrix} r_i(\delta) \\ r_k(\delta) \end{bmatrix}, \delta = \{t_1, t_2, \dots\} \right)$$

where vector $\mathbf{r}^{(*)}$ represents state element repair resource investments at time δ for both physical and service elements and \mathbf{R} is a matrix of planned inter-system linkage increases or decreases.

Similarly, preparedness planning for actions prior to insurgent shock a time tau consists of the triplet

$$\left(\begin{bmatrix} P_{xx}(\delta) & P_{xs}(\delta) \\ P_{sx}(\delta) & P_{ss}(\delta) \end{bmatrix}, \begin{bmatrix} p_i(\delta) \\ p_k(\delta) \end{bmatrix}, \delta = \{t_1, t_2, \dots\} \right)$$

In which the vector $\mathbf{p}^{(*)}$ and matrix \mathbf{P} are similarly defined.

The dynamics imposed on state condition levels used in the approach are derived from expert subjective estimates of pair wise interactive linkage between these components.

This approach has not been adopted in any previous modeling approaches. It leverages previous experimentation with post-disaster infrastructure response dynamics and how influence is propagated in cross-border systems dynamics.

What results is a simple, yet informative exploratory model capable of exposing inference supporting effects patterns we call **interactive schema** – that can be used in a predictive fashion to identify near and mid-term outcomes of strategy decisions on both sides of the competition, including more subtle effects targeting cultural distrust, confidence in government, and other such ingredients that seed the ground for civil conflict.

A small example was created in Excel to illustrate its ability to perform as intended. Three physical elements along with one each of their major service components were modeled and the competition between an insurgent schema and a counter-insurgency strategy was played out over 48 time periods.

When insurgent shocks are imposed on select elements of both the dynamic linkages and state condition vector, it was possible to identify the counter-insurgency schema being imposed on the system purely through observation of effects. The counter-insurgency strategy was played out as reconstruction efforts (preparedness) and responses. What became evident was that there are key elements in the dynamic linkages that drive the final state for the system. If they are targeted by insurgents and missed in the counter-insurgency strategy, reconstruction investments in the state condition vector become irrelevant; the system will decay to an unacceptable state.

This approach hinges on abstracting insurgent behavior in a manner that disassociates incidents from geographic location and conceptualizes these incidents as ‘shocks’ to an otherwise dynamically evolving system-of-systems.

The model can easily accommodate both deterministic and stochastic effects, along with human learning, system degradation and other complicating elements that can improve the fidelity and accuracy of results. The FY08 work with Dr. Fox focuses on extending the model to address both information uncertainty and stochastic insurgent effects.

Perhaps more importantly, because the dynamics and state vectors contain both physical elements and services, these evidence-based schemas can also be used to guide data mining efforts seeking to expose evidence supporting insurgent strategy conjectures. In particular, even for the small model constructed as a proof of concept, it is clear that collecting only incident data involving U.S. forces is insufficient to model the complete effect of insurgent behavior.

Requirements and Milestones: N/A

Project Deliverables and Due Date: N/A

Presentations and Publications:

In-Progress Reviews and Final Briefing

- Driscoll, P. and N. Goerger. 2006. Stochastic System Modeling of Infrastructure Resiliency, Operational Research Society (ORS) Annual Conference, Bath, England.

Personnel Briefed:

- COL Shep Barge, U.S. Army J-8, Washington, DC

Status:

Initial model development is complete. Publication preparation is on-going. Stochastic modeling extended to FY08 with NPS.

NATO Wastewater Reuse Risk Management

DSE Project No: DSE-R-0721

Client Organization: NATO Advanced Research Workshop

Senior Investigator(s): Paul D. West, PhD
COL Timothy E. Trainor, PhD

Points of Contact:

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Prof Nava Haruvy	Netanya Academic College 1 University Rd. Natanya 42100, Israel	972-8-9463189 972-52-3611260 Fax: 972-8-9365345	navaharu@netvision.net.il

Problem Description:

Enhancing public welfare through the deliberate management of water resources is vital for every society. Pollution, overuse, and consumption challenge a society's ability to develop and sustain water supplies for municipal, agricultural, industrial, and recreational use while protecting fisheries and wetlands. Scarce water resources also threaten international and regional security due to water conflicts. Water resource management decisions are complex and involve risk. The client organization is seeking methodologies for water resource risk management for NATO and Mediterranean countries.

Proposed Work:

The Department of Systems Engineering will develop a risk- and values-based decision support system (DSS) for evaluating water resource management alternatives. Specifically, DSE will:

- Identify critical risk factors.
- Provide a structure for valuing risk factors and determining individual and combined factor utility.
- Develop a DSS for quantifiably assessing alternatives based on comprehensive risk factor utility.

Results Summary:

This project produced a risk-based decision support model for designing and managing large-scale water resource projects. The model was briefed at the NATO Advanced Research Workshop on "Wastewater Reuse – Risk Assessment Decision-Making and Environmental Security" in Istanbul, Turkey, on October 13, 2006. The workshop gathered 60 scientists and engineers from 22 countries to address critical issues of water resource management. Participants represented NATO member countries, as well as

NATO Partnership (former Soviet Union) and NATO Dialog (Israel, and Arab states including Egypt and Jordan) countries.

The resulting paper was published as a chapter in *Wastewater Reuse – Risk Assessment and Decision-Making and Environmental Security*, NATO Security through Science, Series C – Environmental Security, Springer Science and Business Media, Dordrecht, the Netherlands.

The premise is that demand for water grows as populations increase and new uses are found and prioritized. Water management infrastructure is costly to build in both time and money and must be sustainable for decades in the face of uncertain future requirements. Comprehensive water management planning must account for risks not only to physical elements of the system, but also to those elements that enable the system to meet changing needs and uncertain times.

Managing the Conowingo “pond” in the northeast United States highlights these challenges. The pond, a 9,000-acre (3,642-hectare) reservoir spanning 14 miles (22.5 kilometers) in Pennsylvania and Maryland, was created in 1928 with the completion of the Conowingo dam. The Conowingo system gradually outgrew its intended purpose of solely providing hydroelectric power, and by the dawn of the 21st Century a complex system of users was dependent on the pond for its survival. Key stakeholders faced this new reality in 2002 with the creation of the Conowingo Pond Workgroup of the Susquehanna River Basin Commission. Their goal was to develop a resource management plan that provides for current and future users while meeting existing state and federal regulations.

This complex decision scenario is used to illustrate how a new, comprehensive risk-based decision support system can help decision makers choose between competing alternatives in both short-term and long-term projects. The approach is to quantify exposure to sources of operational risk, identify measures for assessing their effects, and determine the utility of various alternatives based on the decision maker’s sensitivity to each of the risk categories. The result is an analysis of alternatives that reflects the decision maker’s assessment of risk and willingness to accept it.

Requirements and Milestones:

Written report, conference presentation (Fall 06) *Complete*

Project Deliverables and Due Date:

- Article for publication in *Wastewater Reuse – Risk Assessment, Decision-Making and Environmental Security*, NATO Security through Science; Series: C – Environmental Security: October 2006 *Complete*
- Final Briefing: October 2006 *Complete*
- Technical Report: December 2006 *Complete*

Presentations and Publications:

- West, Paul D., Risk-Based Decision support of Water Resource Management Alternatives, NATO Advanced Workshop presentation, Istanbul. 12 October 2006.
- West, Paul D., and Trainor, Timothy E., Risk-Based Decision support of Water Resource Management Alternatives, published in *Wastewater Reuse – Risk*

Assessment, Decision-Making and Environmental Security, NATO Security through Science; Series C – Environmental Security.

- West, Paul D., and Trainor, Timothy E., Risk-Based Decision support of Water Resource Management Alternatives, Technical Report DSE-TR-0721, DTIC #ADA458328, December 2006.

Personnel Briefed:

- NATO Workshop - Istanbul, Turkey (approx. 20 people attended) - October 2006

Status: *Complete* - December 2006

Weapons Shot Counter Graphic Training Aid

DSE Project No: DSE-R-0723

Client Organization: Special Operations Peculiar Modifications (SOPMOD), Crane Division, Naval Surface Warfare Center (NAVSURWARCENDIV Crane)

Principal Investigator(s): MAJ Gary Kramlich, MS
MAJ Jose Salinas, MS
Senior Investigator: LTC Simon R. Goerger, PHD

Points of Contact:

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Problem Description:

The Special Operations Peculiar Modifications (SOPMOD) group recently awarded a contract for the Weapon Shot Counter (WSC) that records ball ammunition fired from a M4A1 Carbine. This new equipment offers a new capability to track weapon use between users and over the life of a weapon. This new sensor, much like the odometer on a vehicle, provides gunsmiths a better metric to schedule preventive maintenance measures.

While the equipment provides data on weapon use, that data must be compared to historical reliability data to make an estimate of risk. For example, if a weapon shoots 7,000 rounds prior to deployment, what parts on that weapon are most likely to break during the next 12 months in a desert environment? For a Special Operations Forces (SOF) team in deployment, what is the expected number of specific repair parts the team will be expected to need to keep its small arms operational? The Weapons Shot Counter will provide the weapon's current usage "age", but will not help an operator decide when to replace parts until compared to historical records of weapons reliability.

Proposed Work:

Tasks to be performed and issues to address:

- Using findings of Project DSE-R-0625, re-process the PEO Soldier Reliability data to better meet SOPMOD requirements
- Identify stakeholders and conduct needs analysis to capture ideas and issues for endstate capabilities
- Develop Graphical Training Aid for rapid publication prior to software implementation.
- Develop desired output and reports required for operator, gunsmith, and logistic manager level decision making

Results Summary:

The Graphic Training Aid was complete in early March, but once complete, SOPMOD decided to progress with the software development program rather than just a paper form of the Graphic Training Aid. The software development, ORCEN Project DSE-R-0724, received more support from the SOPMOD user organizations and was the clear choice of the Operators they serve. Additionally, after MAJ Kramlich met with the Naval Special Warfare Command (WARCOM) personnel in February 2007, it was also clear that automated logistic support was the desired endstate for the US Navy components of USSOCOM.

The GTA was nonetheless briefed to attendees of the Program Integrated Project Team (PIPT) at Fayetteville, NC in April 2007. This forum is SOPMOD's venue for gathering Operator feedback on their programs. Operators were again very direct in articulating the preference of software support over a GTA. SOPMOD therefore directed the ORCEN to complete work on DSE-R-0723, GTA development, and begin work on DSE-R-0724, software development.

Requirements and Milestones:

Milestones:

Milestone	Tentative Dates
Scope application requirements with client	
o Research current capabilities of SOCOM logistic databases	14 JUN 2007 <i>Completed</i>
o Survey users for desired features	
Graphic Training Aid Published	30 JUN 2007 <i>Completed 15MAR07</i>
In-Progress Review (IPR) with Client	06 SEP 2007 <i>Completed 11MAY07</i>
Technical Report Drafted	08 MAY 2008 <i>Completed 06JUN07</i>
Technical Report Published	15 MAY 2008 <i>Completed 30JUN07</i>

Project Deliverables and Due Date:

- Graphical Training Aide Initial Draft: 30 JUN 2007. ***Delivered 15MAR07***
- Technical Report: 05 JUN 2008 ***Delivered 30JUN07***

Presentations and Publications:

- In-Progress Reviews and Final Briefing 2007 Infantry Weapons Conference, Berlin, Germany, 31 October 2007. Presented to international audience alongside Mr. Jason Davis of SOPMOD.
- Article submitted and accepted by US Army Infantry Journal regarding the use of preventative maintenance in small arms weapons. Published in November-December 2007 issue.

In-Progress Reviews and Final Briefing:

- IPR to SOPMOD personnel during April 5th meeting and again at May 9th meeting.

- Final brief regarding DSE-R-0723 at June 6th meeting. **Status:**
- Project considered closed following the May 9th meeting. All work following that day was in support of the software development, DSE-R-0724. That project is on-going and will continue through Academic Year 2008.

Ammunition Supply Point (ASP) Resource Requirements

DSE Project No: DSE-R-0725

Client Organization: Defense Ammunition Center (DAC)

Principal Investigator: MAJ Ken Gilliam, MS
Contributing Investigator: LTC Rod Roederer, PhD
Senior Investigator: Paul West, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
Mr. Upton R. Shimp	Chief, Education Services Division Defense Ammunition Center McAlester, OK 74501-6000	(918) 420-8846 DSN 956-8846	upton.r.shimp@us.army.mil

Problem Description:

Dynamic organizational changes, to include realignment of missions and Base Realignment and Closure (BRAC), significantly impact the roles and responsibilities within the Department of Defense. Military bases are being consolidated and reprioritized resulting in the reorganization of programs and the modifications to responsibilities. As part of this reorganization, the Defense Ammunition Center (DAC) has been assigned the mission managing the Director of Logistics - Ammunition Supply Point (DOL/ASP) operations at 37 locations in the United States. The DAC requested assistance with identifying the required manpower and facility resources for each of the 37 continental United States (CONUS) installations in order to better support the ammunition needs of the military.

Joint Munitions Command (JMC) Pamphlet No. 210-5 (Draft) outlines the policies, procedures and responsibilities for installation/garrison ammunition management and support, and customers supported by these activities. The Ammunition Supply Point (ASP) concept of operations document and the ASP development guide are designed to assist efforts to transfer DOL/ASP operations from Installation Management Command (IMCOM) to US Army Materiel Command (AMC).

Proposed Work:

- Phase I
 - Conduct back ground research and stakeholder interviews about ASP system
 - Provide concept plan
 - Provide IPR on stake holder analyses and system conceptual model

- Phase II
 - Collect Data from ASPs to feed model requirements
 - Develop conceptual model
 - Provide IPR with model implementation alternatives
- Phase III
 - Develop initial resource model implementation
 - Provide IPR with results CONUS resource model validation
 - Provide IPR with results OCONUS resource model validation
- Phase IV
 - Provide a model (Excel, ProModel, or other modeling/simulation package as appropriate) with user instructions to DAC
 - Provide Technical Report to DAC

Results Summary:

This is ongoing research with a scheduled completion date in summer 2008. Stakeholder interviews are underway. To date, interviews have been conducted at the client organization in McAlester, OK, and with senior stakeholders from the Joint Munitions Command (JMC) and Installation Management Command (IMCOM) and JMC Headquarters at Rock Island, IL. Site visits have been conducted at ammunition supply points (ASPs) at West Point, NY, Ft. A.P. Hill, VA, Ft. Stewart, GA, Ft. Jackson, SC, Ft. Bragg, NC, Ft. Campbell, KY, and Ft. Knox, KY. The purpose of the site visits is to further refine the problem and gain stakeholder input by identifying common and unique features of each ASP. A conceptual model of the ASP system is under construction.

Requirements and Milestones:

- Initial client meetings: NLT 31 May 2007 *Complete*
- ASP site visits: NLT 31 August 2007

Milestones and Deliverables:

Milestones:

Milestone	Tentative Dates
Scope application requirements with client [SDP – Phase I]	
<ul style="list-style-type: none"> • ASP Visits <ul style="list-style-type: none"> USMA (West Point) Ft Drum • Literature Review 	ASAP
Client Meeting (Defense Ammunition Center, McAlester, OK) [SDP – Phase I]	NLT 6 APR 2007
AFSB Interviews (Ft Bragg, Ft Hood, & Ft Lewis) [SDP – Phase I]	NLT 30 APR 2007
Concept Plan [SDP – Phase I]	NLT 30 APR 2007
In-Progress Review (IPR) with Client & AMC General Officers [SDP – Phase I]	NLT 31 MAY 2007
Initial Data Collect – targeting 37 CONUS ASP locations [SDP – Phase II]	NLT 31 AUG 2007
Conceptual Resource Model [SDP – Phase II]	NLT 31 AUG 2007
Initial Prototype Resource Model [SDP – Phase II]	NLT 30 NOV 2007
IPR with Initial Model Demonstration [SDP – Phase II]	NLT 15 DEC 2007
Resource Model Enhancements and Validate (CONUS) [SDP – Phase III]	NLT 31 MAR 2008
IPR with Enhanced/Validated Model Demonstration [SDP – Phase III]	NLT 31 MAR 2008
Resource Model Enhancements and Validate (OCONUS) [SDP – Phase III]	NLT 31 MAR 2008

Milestone	Tentative Dates
Resource Model with user instructions to DAC [SDP – Phase IV]	NLT 31 MAY 2008
Technical Report & Final IPR[SDP – Phase IV]	NLT 30 JUN 2008

Project Deliverables and Due Date:

- Conceptual Resource Model: NLT 31 August 2007
- Prototype Resource Model: NLT 30 November 2007
- Resource Model: NLT 31 May 2008
- Final IPR: NLT 30 June 2008
- Final Technical Report: NLT 30 June 2008

Status:

This is ongoing research with a scheduled completion date in summer 2008.

Army Materiel Command Headquarters Quarters Lean Six Sigma Support

DSE Project No: DSE-R-0726

Client Organization: DCS, G-5, Strategy and Concepts, HQ, United States Army Materiel Command

Senior Investigator(s): Timothy Elkins, PhD
Patrick J. Driscoll, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
Ms. Colleen Carey	Director, Strategic Planning and Integration Directorate DCS, G-5, Strategy and Concepts HQ, United States Army Materiel Command 9301 Chapek Rd, Room 1SE3603 Fort Belvoir, VA 22060-5527	703-806-9082 DSN 656-9082	colleen.carey@us.army.mil
Ms. Cathy Dickens	Special Assistant to the EDCG DCS, G-5, Strategy and Concepts HQ, United States Army Materiel Command 9301 Chapek Rd, Room 1SE3603 Fort Belvoir, VA 22060-5527	703-806-8100 DSN 656-8100	mary.dickens@hqamc.army.mil

Problem Description:

Dynamic organizational changes to include realignment of missions and Base Realignment and Closure (BRAC) significantly impact the roles and responsibilities within Army Materiel Command (AMC). AMC is seeking to design an organization that provides the highest level of service at an efficient cost in preparation for moving the headquarters organization to Huntsville, Alabama by 2011. To accomplish this transition over the next 5 to 10 years, AMC is developing a strategic vision that allows it and its subordinate Life Cycle Management Commands (LCMCs) to synchronize efforts with the changing Army thereby enabling AMC to rapidly react to both forecasted and un-forecasted future demands for services and products driven by global and local scenarios.

The Executive Deputy to the Commanding General (EDCG) has identified immediate focus areas as the BRAC implementation and review of the Headquarters (HQ) AMC staff roles and missions. The BRAC implementation presents a window of opportunity to design a lean, highly effective enterprise using the principles and practices of Lean Six Sigma (LSS).

AMC will assess the roles, mission, processes, and manning of its organization as it prepares to better meet the needs of its customers.

Proposed Work:

The objective of this effort is to provide analytical assistance for and a review of products created by the LSS team working AMC HQ projects related to assessing the roles and missions within AMC. As AMC conducts LSS projects with regards to matters such as the future missions including the impact of Army Force Generation/Modularity

(ARFORGEN) and incorporating emerging technologies into the AMC 2015 strategy, D/SE will provide an outside review of the analytical processes and techniques, to assist AMC HQ with ensuring the validity of its LSS teams products.

Key considerations will include assisting with and reviewing of how well the AMC LSS team assesses the AMC HQ's ability to:

- Align the AMC HQ staff to function as an Operational Command, driving systemic change throughout AMC, and determining the AMC HQ post-BRAC configuration.
- Identify a phased approach for transitioning personnel during BRAC to ensure AMC HQ mission continuity.
- Analyze the impact of increased Army end-strength and Army Force Generation/Modularity (ARFORGEN) on AMC HQ roles and functions.
- Recognize the AMC HQ need to fully support joint operations and build partnerships to support foreign militaries

D/SE will also assist with analyzing emerging technologies and ensuring AMC HQ can capitalize on new technology in rebuilding and modernizing the organization.

Results Summary:

This project was a collaboration with HQAMC to assist them with designing a more efficient and effective organization enabling them to rapidly react to both forecasted and un-forecasted demands for services and products. In the initial phase we provided a review of proposed stakeholder assessment methods and materials, including survey and interview questions as well as critical skills matrices. We provided information on value modeling concepts (versus pure analytical models) and the benefits of assessing "value." We also reviewed LSS products produced by the AMC project team. Some of our recommendations included the development of a deliberate communications plan to ensure awareness and understanding of their strategic vision to the workforce. There also is a need for a HQ communication plan. Another recommendation was better delineation of staff roles and responsibilities and several staff realignment options were provided that could facilitate this. AMC needs to formally document their business processes and develop performance measures that appropriately assess them. While documenting their processes, LSS concepts can be applied. Finally, a common operations planning process should be developed across all of the major subordinate commands (MSCs).

Requirements and Milestones:

This project consists of:

- Reviewing stakeholder assessment methods and materials, assisting in the organization and analysis of LSS products. Using Lean/Six Sigma methodology and coordinating current efforts within AMC to design a new HQ AMC organizational structure provides a statistical, data-driven method of review.
- Future review and analysis as required such as functional analysis focused on functions, processes, and resources.

Assistance and creation of deliverables identified through the project process that are agreed to jointly

Project Deliverables and Due Date:

Deliverables	Tentative Dates
Initial Meeting with Client	06 APR 2007 - <i>Complete</i>
Review of proposed stakeholder survey / questions plus value modeling concepts.	17 APR 2007 – <i>Complete</i>
Appropriate review of LSS products and process	As required
Appropriate analytical duties	As required

Presentations: Client briefs: (2)

- Publications: Initial and final technical reports to client

Status: Research is ongoing

Appropriate Use of Digital Terrain Data for Operational Testing of Battle Command Systems

DSE Project No: DSE-R-0727

Client Organization: U.S. Army Topographic Engineering Center (TEC)

Principal Investigator(s): LTC Robert Kewley, PhD
LTC Michael Hendricks, PhD

Contributing Investigator: J. David Lashlee, PhD

Points of Contact:

NAME	ADDRESS	PHONE	OTHER
J. David Lashlee, PhD	ERDC - TEC	703-428-7133	J.David.Lashlee@erd.c.usace.army.mil

Problem Description:

The US Army Future Combat Systems (FCS) program has published objective requirements for the availability of high resolution terrain data for possible areas of operation with very short notice about that operation. For most of the world, these data do not exist today. Even with significant advances in data collection and analysis, supported by higher funding levels, the National Geospatial Intelligence Agency (NGA) will not likely be able to cover the entire world. They will have to prioritize their efforts to pursue collection of the most valuable features and content in the most critical areas of operation. In addition, given a mission, a joint force would employ its own assets to collect or purchase data over and above that provided by NGA.

As the FCS program progresses from experimentation to developmental and operational testing, a problem exists as to what resolution, fidelity, and spatial coverage of data is appropriate for use by the test community in different applications. For example, data availability in theater depends on significant factors such as ownership of the terrain, availability of data collection and analysis resources, amount of operational planning already done for the area, availability of commercial data, and advanced warning time. These factors may vary from operation to operation and scenario to scenario.

Proposed Work:

This research will develop and use a methodology by which the FCS Combined Test Organization (CTO) and Army Test and Evaluation Command (ATEC) can make suitable decisions about the kind of terrain data to provide FCS Battle Command applications for a given test scenario. This methodology will look at the resources required to achieve different levels of detail for critical geospatial features or layers. These resources include data collection, data processing, analyst time, data storage, and dissemination resources. The methodology will also consider whether the operational situation would allow these resources to be effectively employed. For example, the

command would not be able to fly a data collection mission over a hostile area without control of the airspace and suppression or neutralization of enemy air defense weapons.

Using this methodology, the research team will: 1) analyze a specific test scenario at Fort Bliss - White Sands Missile Range (WSMR) and make specific recommendations about what features and levels of detail to provide the FCS tactical units for use in their battle command applications. In addition, the research team will work with FCS CTO to evaluate the value of different levels of detail for key features and layers as that unit plans and executes different tactical missions.

Results Summary:

As the capabilities of battle command systems become greater, they make more use of embedded terrain data within planning, execution, and visualization tasks for operational units. The concurrent evolution of processes for collecting, analyzing, formatting, and disseminating terrain data forces operational testers to explicitly consider the availability of terrain data in development of the test plan. This report proposes a methodology by which test planners can make good decisions about the amount of detail they allow test units to read into their command and control systems for a test event. These decisions are based on key aspects of the scenario and the availability of resources to collect, analyze, format, and distribute that data. They consider the amount of data collected for the operational area prior to the introduction of forces. This depends on who controls the battlespace and the amount of contingency planning conducted for that area. They also consider the availability of other resources to collect data once the unit is mobilized to fight in that area. These resources include time available, the technical means to collect source data, the degree of battlespace control, trained analysts to process and format the data, and communications channels to disseminate the data. As an illustrative example, this report includes three data sets developed for the Fort Bliss – White Sands Missile Range training area to represent three use cases for this methodology. It also includes the results of a tactical planning exercise in which tactical planners developed small scale tactical plans using illustrative data sets. Feedback from the planners provides insights about the value of different data layers at different levels of detail for these sample operations.

Requirements and Milestones: (assumes project start beginning March 2007):

Milestone	Dates
Preliminary Assessment at USMA (Cadet Capstone)	May 2007
Methodology development to determine availability of terrain data given a scenario.	August 2007
Classified data availability case studies	September 2007

Project Deliverables and Due Date:

- | | |
|---------------------------|----------------|
| • Methodology description | August 2007 |
| • Classified case studies | September 2007 |
| • Draft report | September 2007 |

Presentations and Publications:

In-Progress Reviews and Final Briefing

TBD

Personnel Briefed:

TBD

Status:

USMA report submitted to Topographic Engineering Center in September 2007. Report is under technical and editorial review by TEC before being forwarded to Future Combat Systems Combined Test Office.

Comparing Organic vs. Handoff UAV Support to the Maneuver Company

DSE Project No: DSE-R-0728

Client Organization: Internal Research

Principal Investigator: Roger Chapman Burk, PhD
Contributing Investigator: Robin Kowalchuk Burk, MBA

Problem Description:

The US Army has plans to deploy a dedicated Unmanned Aerial Vehicle (UAV) system at every echelon in order to provide responsive support to the battlefield commanders. However, there are disadvantages to fielding such a large number of different and separately controlled vehicles. This research addresses one key part of this issue of selecting the right mix of UAV systems: How shall a company be supported? We consider two alternatives for the company commander, loosely based on systems currently under development: (1) the “Organic” system, which consists of two vehicle-transported VTOL vehicles of ~50 kg each assigned to each company and flying missions when needed; and (2) the “Handoff” system, a 100-200 kg vehicle in the air constantly during operations, maintained and launched at the battalion level, but handed off as needed to the companies, which have Level IV control capability.

Proposed Work:

This work grew out of cadet integrated design projects in Ms. Robin Burk’s sections of SE450, Project Management and System Design, during AY2005-06. Dr. Roger Burk played the role of client and advisor in these projects. Because of the relevance of the topic and the methodological interest of some of the cadets’ approaches, Dr. Burk used part of his sabbatical in AY2006-07 to develop and integrate the various approaches as an independent research project.

The approach was to first do a thorough value analysis for the problem, then focus on performance measures that are strongly affected by the architecture and on finding closed-form approximations that allow extensive sensitivity analysis. We used high-level queuing and Markov chain models to estimate performance.

Results Summary:

We found that the results are sensitive to scenario parameters, but under many circumstances maneuver companies are equally well served by the two systems, and sometimes they are better served by the “Handoff” system. We also found that “Organic” system has inherent disadvantages of cost and complexity, and we found no similar disadvantages for the “Handoff” system. We identified performance and scenario parameters that have a strong effect on this and consequently deserve more study.

Requirements and Milestones:

- Develop Value Model
- Develop closed-form analytical models for quantitative measures
- Assess performance of two systems
- Perform wide-ranging sensitivity analysis

Project Deliverables and Due Date:

- Technical Report, June 2007 *Complete*

Presentations and Publications:

- “Comparing Organic vs. Assigned UAV Support to the Maneuver Company” published in refereed on-line proceedings of Symposium on Platform Innovations and System Integration for Unmanned Air, Land and Sea Vehicles (AVT-146), North Atlantic Treaty Organization Research and Technology Agency, Florence, Italy; also presented at the conference (17 May 07)
- “Comparing Organic vs. Assigned UAV Support to the Maneuver Company” presented at 75th Military Operations Research Society Symposium, Annapolis, MD (14 Jun 07)

Personnel Briefed: None

Status: Paper being prepared for peer review and archival publication.

PART VI - Faculty Activity, Academic Year 2007

(* Indicates multiple department authors)

Figure IV.1 is a roll-up of DSE faculty activities for Academic Year 2007. The numbers represented are inclusive.

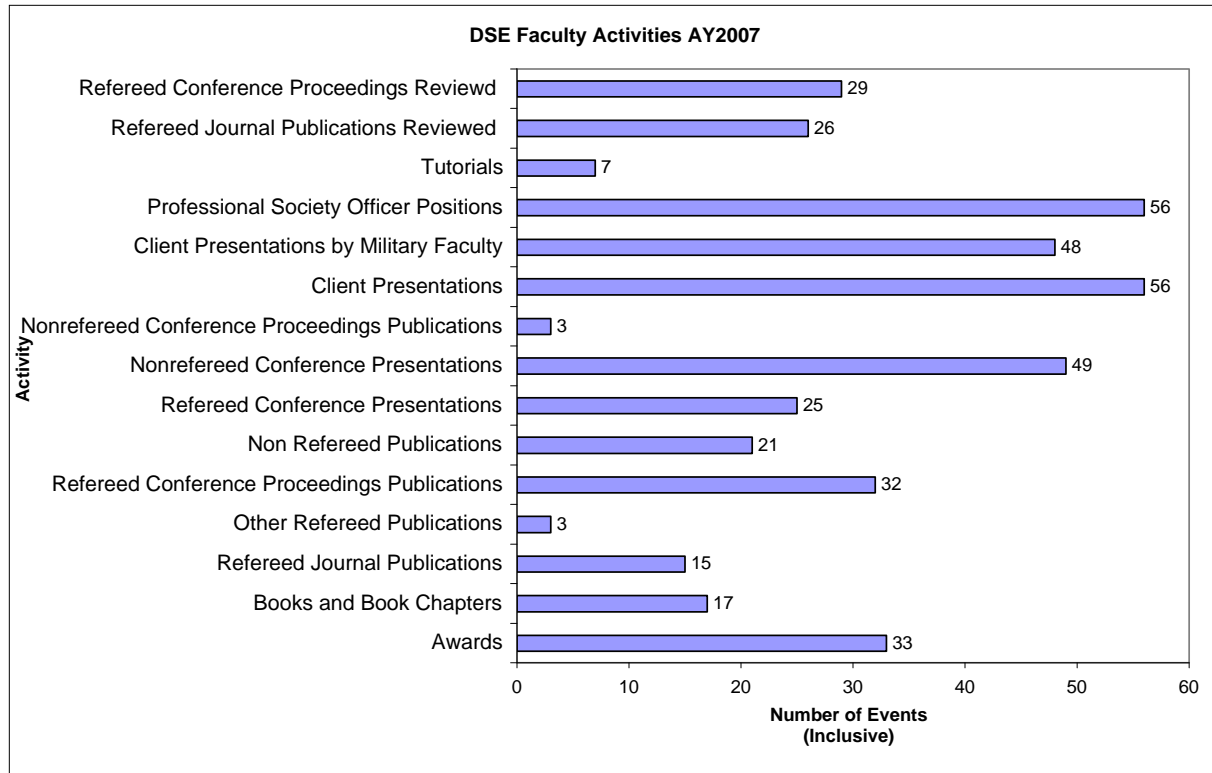


Figure IV.1 Department of Systems Engineering Faculty Activities for Academic Year 2007

The remainder of this section is a layout of specific faculty activities for each of the DSE faculty members for Academic Year 2007. These are the activities reported by each faculty member as of 31 May 2007 and are inclusive from 01 July 2006 until 30 June 2007.

BOYLAN, GREGORY, MS., MAJOR

Awards

Winner, John K. Walker Award for best article in Phalanx for calendar year 2006
Nominee, Wilbur E. Payne Award for Excellence in Operations Research, Oct 2006

Refereed Journal Publications

Boylan, G. L., B. L. Foote, R. Burk, "A Preliminary Analysis of Loitering Aircraft as a Capability Added to Anti-Ballistic Missile Systems," submitted to *Military Operations Research Journal*, February 2006, in second review

Tollefson, E.S., G.L. Boylan, and M.J. Kwinn, Jr., "A Systems Engineering Approach to Determining Simulation Requirements for the Acquisition of Infantry Soldier Tactical Mission Systems," submitted to *Military Operations Research Journal*, January 2006, in review.

Refereed Conference Proceedings Publications

Boylan, G. L., S. R. Goerger, 2006, "Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers," presented at the US/Canadian Operations Research Symposium, Halifax, Nova Scotia, 12 September 2006.

Goerger, S. R., N. C. Goerger, G. Griffin, P. F. Evangelista, P. W. Richmond, and G. L. Boylan (presenter), 2006, "Using Agent-Based Models to Assess Vehicle Borne Improved Explosive Device Strategies," presented at the US/Canadian Operations Research Symposium, Halifax, Nova Scotia, 13 September 2006.

Boylan, G. L., S. R. Goerger, and G. Griffin (presenter), 2006, "Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers," presented at the Simulation Interoperability Workshop, Orlando, FL, 13 September 2006.

Refereed Conference Presentations

Boylan, G. L., S. R. Goerger, 2006, "Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers," presented at the US/Canadian Operations Research Symposium, Halifax, Nova Scotia, 12 September 2006.

Boylan, G. L., S. R. Goerger, and G. Griffin (presenter), 2006, "Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the

Capabilities of Future Battle Command Training Centers,” presented at the Simulation Interoperability Workshop, Orlando, FL, 13 September 2006.

Conference Presentations (Presented by not Authored)

Goerger, S. R., N. C. Goerger, G. Griffin, P. F. Evangelista, P. W. Richmond, and G. L. Boylan (presenter), 2006, “Using Agent-Based Models to Assess Vehicle Borne Improved Explosive Device Strategies,” presented at the US/Canadian Operations Research Symposium, Halifax, Nova Scotia, 13 September 2006.

Client Presentations

Trainor, T. E., G. L. Boylan, M. Carlson, G. Huntsinger, and E. Teague, “Feasibility Assessment of Cadet Barracks Privatization,” Presentation to COL Crawford, USMA Garrison Commander, 27 December 2006. ***** this was followed shortly thereafter by a briefing to LTG Hagenbeck, USMA Superintendent *****

Boylan, G. L., “Final IPR for the Simulation-Based Design of Battle Command Training Centers Project, Phase II,” Presentation to LTC Darran Anderson, HQDA G-3, Final IPR, 17 May 2007.

Professional Society Officer Positions

Faculty Advisor, USMA Chapter of Alpha Pi Mu.

Professional Society Officer Positions

Member, USMA Space Allocation Committee, United States Military Academy, Sep 2006 – Present.

Member, U.S. Delegation to the 11th Annual U.S./Canadian Operations Research Symposium, Halifax, Nova Scotia, 11-14 September 2006.

BURK, ROGER C., PhD

Awards

Walker Award for best paper published in *Phalanx* (with Greg Boylan and Bobbie Foote)

Books or Book Chapters

Chapter 6 , “Systems Engineering in Professional Practice,” of *Systems Decision Making in Systems Engineering and Management*, ed. Parnell, Driscoll, and Henderson

Refereed Conference Proceedings Publications

“Comparing Organic vs. Assigned UAV Support to the Maneuver Company,”
Symposium on Platform Innovations and System Integration for Unmanned Air,
Land and Sea Vehicles, North Atlantic Treaty Organisation Research and
Technology Agency, Florence, Italy,
<http://www.rta.nato.int/Pubs/doc.asp?paper=RTO%2DMP%2DAVT%2D146%2DP%2D31%2DBurk%2Epdf&pubid=2806&pt=http> (with Robin K. Burk)

Refereed Conference Presentations

“Comparing Organic vs. Assigned UAV Support to the Maneuver Company,”
Symposium on Platform Innovations and System Integration for Unmanned Air,
Land and Sea Vehicles, North Atlantic Treaty Organisation Research and
Technology Agency, Florence, Italy, 17 May (with Robin K. Burk)

Non-Refereed Conference Presentations

“Requirements for Autonomous Collision Avoidance for Unmanned Aerial Vehicles in
the National Air Space” (with Karhoff, Limb, Oravsky, and Shephard) at
Colorado Springs MORSS, 14 Jun 06

Professional Society Officer Positions

MAS Council

Number of Refereed Journal Publications Reviewed:

3 – *Military Operations Research*

1 – *Decision Analysis*

CARLSON, MELANIE, MS, MAJOR

Refereed Conference Presentations

Carlson, Melanie I., Parnell, Gregory, “Assessing Security Cooperation Programs,” 75th
MORSS, USNA, Annapolis, Maryland, July 2007.

CRINO SCOTT, PhD, MAJOR

Awards

Phi Kappa Phi International Academic Honor Society inductee, 7 May 2007

Refereed Journal Publications

Crino, S. and Brown, D., 2005. Global Optimization Using Multivariate Adaptive Regression Splines. To be published in *IEEE Transactions on Systems, Man and Cybernetics-Part B*, 37(2):333-340, April.

Refereed Conference Proceedings Publications

Crino, S., McCarthy, D. and Carier, J. 2007. Lean six Sigma for the Army Rapid Fielding Initiative. *Proceedings from the First Annual International Systems Conference*, Honolulu, HI, April.

Refereed Conference Presentations

Crino, S., McCarthy, D. and Carier, J. 2007. Lean six Sigma for the Army Rapid Fielding Initiative. *Proceedings from the First Annual International Systems Conference*, Honolulu, HI, April.

Client Presentations

Crino, S., "Army Rapid Fielding Initiative," Warehouse site visit in Middle River, MD, October 2007

Crino, S. and Griffin, G., "Army Rapid Fielding Initiative In Progress Review 1," Special Assistant for the Rapid Fielding Initiative, PEO-Soldier, United States Military Academy, West Point, NY 11 January 2007.

Crino, S. "Army Rapid Fielding Initiative Update," Research update to BG Brown, PEO-Soldier United States Military Academy, West Point, NY 28 March 2007.

Crino, S. McCarthy, D. and Griffin, G., "Army Rapid Fielding Initiative Business Case Study," Final project report to the special assistant for the Rapid Fielding Initiative, PEO-Soldier, Fort Belvoir, VA, 16 May 2007.

Refereed Journal Publications Reviewed:

IEEE Transactions on Systems, Man and Cybernetics, Part A.

Refereed Conference Proceedings Publications reviewed:

"Usability Study of the Joint Analysis System," Systems and Information Engineering Design Symposium, University of Virginia, 26 April 2007.

"LSS for the Army Rapid Fielding Initiative," Systems and Information Engineering Design Symposium, University of Virginia, 26 April 2007.

Professional Committee Representations

Session coordinator for the International Institute for Operations Research and
Management Sciences (INFORMS) Conference, 9-12 July 2007

DRISCOLL, PATRICK J., PhD

Awards

Military Operations Research Journal – *Best Published Paper of 2007*, “A meta-model for fusing battlefield information,” with Major Steve Henderson.

Black Belt Certification, U.S. Army Lean Six Sigma Program, U.S. Military Academy, West Point, New York, April 2007.

Books or Book Chapters

Parnell, G., P.J. Driscoll, and D. Henderson, eds. 2007. *Decision Making in Systems Engineering & Management*, John Wiley & Sons, New York, New York.

Driscoll, P.J. 2006. “Systems thinking,” book chapter in *Decision Making in Systems Engineering & Management*, John Wiley & Sons, New York, New York.

Driscoll, P.J. 2006. “Systems life cycle,” book chapter in *Decision Making in Systems Engineering & Management*, John Wiley & Sons, New York, New York.

Non-Refereed Conference Presentations

Driscoll, P.J., and N. Goerger July 2006. “Stochastic System Modeling of Infrastructure Resiliency,” Homeland Security in the 21st Century, Military Application Society Conference, Mystic, CT.

Driscoll, P.J., and N. Goerger July 2006. “Stochastic System Modeling of Infrastructure Resiliency,” Operational Research Society (ORS) Annual Conference, Bath, England.

Driscoll, P.J., and N. Goerger. November 2006. “Stochastic System Modeling of Infrastructure Resiliency,” Institute for Operations Research & the Management Sciences, Pittsburgh, PA.

Client Presentations

Driscoll, P.J. April, 2007. “Improving the DES MCA Case Management System,” USMA Lean Six Sigma project on improving the efficiency and effectiveness of MP case management system.

Tutorials delivered

Parnell, G., and P.J. Driscoll. February 2007. One day tutorial on: “Systems decision making for leaders and analysts,” as part of special MORS 3-day program: “A tutorial on equipping the analysis toolkit,” Johns Hopkins Jet Propulsion Laboratory, Baltimore, Maryland.

Professional Society Officer Positions

Chairperson, COMAP Subcommittee, INFORMS

President-elect, Military Applications Society (MAS), INFORMS

Number of Refereed Journal Publications Reviewed: *(number and Journal Publication)*

3 Military Operations Research Journal

2 Computers & Mathematics Journal

Professional Committee Representations

Head Judge and Associate Director, Mathematical Contest in Modeling (MCM),
February – March 2007, Monterey, California.

Head Judge, High School Mathematical Contest in Modeling (HiMCM), San Antonio,
Texas, February 2007.

ELKINS, TIMOTHY, PhD

Awards

Best Paper / Presentation, Reengineering Systems Track, United States Military Academy Capstone Conference, 3 May 2007.

Lean Six Sigma Black Belt Diploma, 4 April 2007.

Omega Rho International Honor Society for Operations Research and Management Science Inductee, May 2006

Refereed Conference Proceedings Publications

Kewley, Robert, and Tim Elkins, "Teaching Command and Control Systems at the United States Military Academy," accepted for publication in the 12th International Command and Control Research and Technology Symposium Proceedings, June 2007.

Non-Refereed Publications

Elkins, Timothy, and Patrick J. Driscoll, "Review of Army Material Command's Stakeholder Survey Review," white paper on behalf of AMC as part of DSE-R-0726 (AMC HQ Roles and Mission to Support "AMC 2015" Strategy), April 2007.

Elkins, Timothy, "Army Studies Program Management Office Database Security," technical report presented to ASPMO (G8) based on capstone research project, May 2007.

Elkins, Timothy, Catherine Rice, and Jennifer Cosgrove, "Naval War College Faculty Survey: Job Satisfaction and Needs Assessment," a white paper written on behalf of the Naval War College, Newport, RI, May 2007.

Refereed Conference Presentations

Cosgrove, Jennifer, Timothy Elkins, and Catherine Rice, "Job Satisfaction and the Professoriate," Association for the Advancement of Educational Research, 9th Annual Conference, 10 November 2006.

Client Presentations

Elkins, Timothy, et. al., "Army Studies Program Management Office Database Security," final capstone project brief to the Deputy G8, 24 April 2007.

Elkins, Timothy, Catherine Rice, and Jennifer Cosgrove, “Naval War College Faculty Survey: Job Satisfaction and Needs Assessment,” brief to NWC leadership, Newport, RI, June 11 2007 (tentative).

Professional Society Officer Positions

Board of Directors, Association for the Advancement of Educational Research

Division Chair (Management Science & Operations Research), Association for the Advancement of Educational Research.

Board of Advisors, Law of Armed Conflict Center of Excellence, Department of Law, United States Military Academy.

Other Refereed Publications Reviewed

Harvard Business Review-Like Case Study (1) – peer review for the Office of Force Transformation’s Network Centric Operations Study Series.

Other:

1. Mathematical Contest in Modeling / Interdisciplinary Contest in Modeling (MCM/ICM), Consortium of Mathematics and Its Applications (COMAP) – Regional Paper Judge
2. Hollis Award Screening

Professional Committee Representations

Steering Committee / Sponsor, Law & Terrorism Conference, Law of Armed Conflict Center of Excellence, Department of Law, United States Military Academy, 25-27 April 2007.

EVANGELISTA, PAUL F., PhD, MAJOR

Awards

I/ITSEC Graduate Student (Doctoral) Scholarship
Karger Dissertation Award (Rensselaer Polytechnic Institute)
Inducted into Alpha Pi Mu Honor Society

Refereed Conference Proceedings (List each by name)

Evangelista, Paul F., Mark J. Embrechts, and Boleslaw K. Szymanski. "Data Fusion for Outlier Detection through Pseudo-ROC Curves and Rank Distributions," IJCNN 2006, Vancouver, Canada, July 2006.

Embrechts, Mark J., Evangelista, Paul F., Bram Heyns, Walter Bogaerts. "Automated Text Categorization Based on Readability Fingerprints." International Conference on Artificial Neural Networks, Porto, Portugal, September 2007

Evangelista, Paul F., Mark J. Embrechts, and Boleslaw K. Szymanski. "Some Properties of the Gaussian Kernel for One Class Learning." International Conference on Artificial Neural Networks, Porto, Portugal, September 2007

Dissertation

Evangelista, Paul F. "The Unbalanced Classification Problem: Detecting Breaches in Security." Dissertation, Rensselaer Polytechnic Institute, December 2006.

Non-Refereed Conference Presentations

MORS Presentation: "Datamining for Geospatial Threat Templating", 74th MORS 2006.
INFORMS Presentation: "Datamining for Geospatial Threat Templating"

GAUTHIER, STEVEN, MS, MAJOR

Refereed Conference Presentations

Kwinn, M.J., Gauthier, S.E. “Quantitatively Assessing President George W. Bush’s National Security Strategy”, Presentation for the Quantitative Methods in Defense & National Security, George Mason University, Fairfax, VA; 7 February 2007.

Kwinn, M.J., Gauthier S.E., and M.R. Weisner, “Implementing a Quantitative Assessment for the National Security Strategy”, Presentation and paper for the Cornwallis XII, Pearson Peacekeeping Institute, Clementsport, Nova Scotia, Canada; 2 April 2007.

GILLIAM, KEN, MS, MAJOR

Awards

Phi Kappa Phi National Honor Society 2007 Literacy Grant for Project MathWORKS!
(West Point Operations Research Knowledge Society), April 2007-March 2008

Conference Presentations (Presented but not Authored)

“Project MathWORKS – Introducing Operations Research to High School Students.”
Presented at the 2007 Joint Mathematics Meeting, 5-8 January 2007, New Orleans, LA.

Client Presentations

“Systems Decision Process Overview” Presented to the Defense Ammunition Center,
McAlester Army Ammunition Plant, 4 April 2007, McAlester, OK. (DSE-R-0725)

Tutorials Delivered

“What is Systems Engineering?” Presented at Discover Engineering Day, 4 May 2007,
Wallenpaupack, PA.

GOERGER, MARIA N., PhD

Awards

SIWzie nomination for must see paper presentation at 2006 Fall Simulation Interoperability Workshop, Orlando, Florida, 02-07 September, 2006.

Books or Book Chapters

Robin Burk, Niki Goerger, Burhman Gates, Curt Blais, Joyce Nagel, and Simon Goerger. "Knowledge Representation for Military Mobility Decision-Making by Humans and Intelligent Software Agents," *Extending the Horizons: Advances in Computing, Optimization, and Decision Technologies. Operations Research/Computer Science Interfaces Series*, 247-266. January 2007.

Refereed Journal Publications

Paul W. Richmond, Curtis L. Blais, and Niki C. Goerger. "Development of a Ground Vehicle Maneuver Ontology to Support the Common Operational Picture", *CrossTalk The Journal of Defense Software Engineering*. July 2006.

Refereed Conference Proceedings Publications

Goerger, Niki C., Simon R. Goerger, Gregory C. Griffin, Paul W. Richmond, and Paul F. Evangelista. "Insights into Insurgent Decisioning and Response to Traffic Flow Strategies," 06F-SIW-098, 2006 Fall Simulation Interoperability Workshop, Orlando, FL, September, 2006.

Nagle, Joyce A., Curtis L. Blais, Robin K. Burk, Burhman Q. Gates, Niki C. Goerger, and Paul W. Richmond. "The Mobility Common Operational Picture Data Model: A Foundation for Conceptual Interoperability in the Domain of Ground Vehicle Mobility and Maneuver," 06F-SIW-005, 2006 Fall Simulation Interoperability Workshop, Orlando, FL, September, 2006.

Wong, Ernest, Niki Goerger, Robert Keeter, and Simon Goerger. "Creating the Army Digital Terrain Catalog—A Case Study in Rapid Prototyping and Allowing Market Forces to Help Determine Standards," 10th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI), Orlando , FL. 16-19 July 2006.

Non-Refereed Publications

Goerger, Niki C. "From the Secretary," *PHALANX*, vol. 39, number 4 December 2006.

Goerger, Niki C. "How Systems Engineering Affects Our Everyday Lives," *Pointer View*, 3 November 2007.

Refereed Conference Presentations

Goerger, Niki C., Simon R. Goerger, Gregory C. Griffin, Paul W. Richmond, and Paul F. Evangelista. "Insights into Insurgent Decisioning and Response to Traffic Flow Strategies," 06F-SIW-098, 2006 Fall Simulation Interoperability Workshop, Orlando, FL, September, 2006.

Nagle, Joyce A., Curtis L. Blais, Robin K. Burk, Burhman Q. Gates, Niki C. Goerger, and Paul W. Richmond. "The Mobility Common Operational Picture Data Model: A Foundation for Conceptual Interoperability in the Domain of Ground Vehicle Mobility and Maneuver," 06F-SIW-005, 2006 Fall Simulation Interoperability Workshop, Orlando, FL, September, 2006.

Wong, Ernest, Niki Goerger, Robert Keeter, and Simon Goerger. "Creating the Army Digital Terrain Catalog—A Case Study in Rapid Prototyping and Allowing Market Forces to Help Determine Standards," 10th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI), Orlando , FL. 16-19 July 2006.

Non-Refereed Conference Presentations

Institute for Operations Research and the Military Sciences (INFORMS) Military Applications Society (MAS) Conference on Homeland Security, August 2006, Mystic, CT. Co-authored invited presentation on developing a means to measure resiliency and assess prevention and recovery alternatives for large metropolitan areas.

Stochastic Modeling of Infrastructure Resiliency, Operational Research Society, September 2006, Bath England.

Session Chair, Military Applications I, Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, November 2006 in Pittsburgh, Pennsylvania. (Chaired Session with 5 presentations)

Goerger, Niki C. and Patrick J. Driscoll. "Decision Support Model for Metropolitan Disaster Response Planning," Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, November 2006 in Pittsburgh, Pennsylvania. (invited presentation)

Driscoll, Patrick J. and Niki C. Goerger. "Linear Stochastic Systems Model for Counter-Insurgency Strategies," Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, November 2006 in Pittsburgh, Pennsylvania. (invited presentation)

Gates, Burhman Q, Niki C. Goerger, Curtis L. Blais, Joyce A. Nagle, and Paul W. Richmond. "Reasoned Maneuver using and Ontology Instance Base," Military Operations Research Society Symposium, June 2007.

Goerger, Niki C., Gregory C. Griffin, Paul W. Richmond, Simon R. Goerger, and Paul F. Evangelista. "Furthering Insights into Insurgent Decisioning and Response to Traffic Flow Strategies using Agent-Based Models," Military Operations Research Society Symposium, June 2007.

Evangelista, Paul F., Dale Henderson, and Niki C. Goerger. "Driving Factors Influencing Effectiveness in the C-IED Fight," Military Operations Research Society Symposium, June 2007.

Client Presentations

Dr. Thomas H. Killion, Deputy Assistant Secretary for Research and Technology / Chief Scientist under the Assistant Secretary of the Army for Acquisition, Logistics, and Technology

Steve Kirin, Director, Operations Research Division, Joint Improvised Explosive Device Defeat Organization (JIEDDO); GEN Dave Maddox (ret.), Dr. Seth Bonder, Brian Barr, and Dr. Pollock (University of Michigan) as part of JIEDDO monthly interim progress reviews (August 2006 – present)

Dr. Bert Davis, Director, Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center (ERDC)

Professional Society Officer Positions

Executive Council, Military Operations Research Society – Secretary, June 2006 to present.

Board of Directors, Military Operations Research Society, June 2004 to present.

Military Environmental Factors, Working Group Advisor, Military Operations Research Society, July 2006 to present.

Number of Refereed Journal Publications Reviewed: 2

Invited reviewer for *Journal for Simulation, Systems, Science, and Technology*, March 2007 special edition (1 journal article submission).

Reviewer for *Journal of Terramechanics* (1 journal article submission).

Professional Committee Representations

US Army Engineer Research and Development Center Representative to the Urban Operations Focus Area Collaborative Team, Executive Committee (October 2001 to present).

US Army Engineer Research and Development Center Representative to the Soldier Focus Area Collaborative Team Executive Committee (October 2005 to present).

Army Model and Simulation Standards Working Group – Member (since charter August 2006 to present) (replaced the Standards Category Coordinators).

Military Operations Research Society Special Meeting Committee, “*Analyzing the Value of Infrastructure*”, August – November 2006, Carlisle, Pennsylvania.

Military Operations Research Society, Prize Committee, Reviewer for Richard H. Barchi Prize, January – March 2007.

Military Operations Research Society, Prize Committee, Reviewer for Wanner Award Prize, April 2007.

Joint Improvised Explosive Device Defeat Organization (JIEDDO) Counter-Improvised Explosive Device (C-IED) by invitation-only Analysis Workshop, 3-4 April 2007, Alexandria, Virginia.

Army Research Institute and the United States Military Academy invitation-only
“Network Science in Full-Spectrum Operations” Workshop, 18-20 April 2007,
West Point, New York.

Military Operations Research Society Symposium (MORSS), Advisor for Special
Session on Joint Improvised Explosive Device Defeat Issues and Potential
Solutions for the June 2007 Annual Symposium (December 2006 – June 2007).

Proposal Reviews

Reviewer for Army Research Office, Terrestrial Sciences, Broad Agency Announcement
Program, April 2007 (1 proposal).

Reviewed over 19 proposals seeking funding as member of the Executive Committee for
the Urban Operations Focus Area Collaborative Team and Solider Focus Area
Collaborative Team.

GOERGER, SIMON R., PHD, Lieutenant Colonel

Awards

SIWzie nomination for must see paper presentation at 2006 Fall Simulation Interoperability Workshop, Orlando, FL, 10-15 September 2006.

Alpha Pi Mu Induction

Phi Kappa Phi Induction

Books or Book Chapters

Co-Author, Chapter 3 of *Fundamentals of Systems Decision Making in Systems Engineering and Management*, Spring 2007.

Co-Author, Chapter 4 of *Fundamentals of Systems Decision Making in Systems Engineering and Management*, Draft 2007.

Refereed Conference Proceedings Publications

Ernest Wong, William Bland, & Simon Goerger. "The Armed Forces Casualty Assistance Readiness Enhancement System (CARES): A Case Study in Rapid Prototyping and Design for Flexibility." *Proceedings of the 40th Annual Hawaii International Conference on System Sciences*, Computer Society Press, 3-6 January 2007, Big Island, HI.

Goerger, Simon R. and Boylan, Greg. "Capabilities-Based Battle Command Training Center Design in Army Transformation", 06F-SIW-101, *2006 Fall Simulation Interoperability Workshop*, Orlando, FL, 10-15 September, 2006.

Goerger, Niki C., Richmond, Paul, Griffin, Gregory C., Goerger, Simon R., and Evangelista, Paul. "Insights into Insurgent Decisioning and Response to Traffic Flow Strategies", 06F-SIW-098, *2006 Fall Simulation Interoperability Workshop*, Orlando, FL, 10-15 September, 2006.

Non-Refereed Publications

Burk, Robin, Niki C. Goerger, Buhrman Gates, Curtis Blais, Joyce A. Nagle, and Simon R. Goerger. "Knowledge Representation for Military Mobility Decision-Making by Humans and Intelligent Software: The Mobility Common Operational Picture Data Model and Ontology", *10th INFORMS Computing Society Conference*, Coral Gables, FL, 3-5 January 2007.

Non-Refereed Conference Presentations

Boylan, Greg, and Goerger, Simon R. "Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers", *11th US / CA OR – Symposium*, Halifax, Nova Scotia, 12-14 September 2006.

Goerger, Niki C., Griffin, Greg C., Goerger, Simon R., Richmond, Paul, and Evangelista, Paul. "Using Agent Based Models to Assess Vehicle Borne Improvised Explosive Device Strategies", *11th US / CA OR – Symposium*, Halifax, Nova Scotia, 12-14 September 2006.

Goerger, Niki C., Griffin, Greg C., Goerger, Simon R., Richmond, Paul, and Evangelista, Paul. "Using Agent Based Models to Assess Strategies against Asymmetric Warfare", Presenters: Dr Niki Goerger & MAJ Gregory Griffin; Authors: Dr Niki Goerger, LTC Simon Goerger & MAJ Gregory Griffin, *2006 Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting*, Pittsburgh, PA, 05-08 November 2006.

Goerger, Simon R. and Wong, Ernest. "Six Sigma and Simulation: A Yin and Yang Approach Towards the Pursuit of Better", *2006 Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting*, Pittsburgh, PA, 05-08 November 2006.

Goerger, Simon R. and Boylan, Greg. "Developing Capabilities-Based Battle Command Training Centers for the Future Force", *2006 Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting*, Pittsburgh, PA, 05-08 November 2006.

Goerger, Simon R. and Wong, Ernest. "Defining Meaningful Metrics for this New Century: A Condition-Based Maintenance Example", *2006 Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting*, Pittsburgh, PA, 05-08 November 2006.

Wong, Ernest and Goerger, Simon R. "CARES: A Tool that Enhances the Military's Casualty Program", *Quality Drives Lean Conference & Expo*, Atlanta, GA, 30-31 October 2006.

Client Presentations

Visitor Demos – 12

Dr. Thomas H. Killion, Deputy Assistant Secretary for Research and Technology / Chief Scientist under the Assistant Secretary of the Army for Acquisition, Logistics, and Technology

Mr. Walter W. Hollis, Deputy Under Secretary of the Army (OR) - Retired

Mr. Michael F. Bauman, Director U.S. Army and its Training and Doctrine Command (TRADOC)

LTG Hagenbeck, Superintendent USMA

MG Nai-Shen Yang, Chief of Staff of the Chinese Military Academy

BG Brown, PEO Soldier (2)

BG Finnegan, Dean USMA

Mr Rezek, Director of the Continuous Process Improvement

COL Wilmer, Requirements Integration Directorate

COL Torgersen, Director Army Casualty and Memorial Affairs
COL Gawkins, Director Army Casualty and Memorial Affairs
Visiting German Cadets (4)
Initial Client Meetings – 12 (Casualty Assistance Office, Joint IED Task Force, PEO Soldier, PM Soldier, etc...)
In-Progress Reviews – 7 (BCTC, EBASS, AF-CARES, PEO Soldier, PM Soldier)
Final Briefings – 6 (BCTC, AF-CARES, PEO Soldier)

Tutorials delivered

Equipping the Analysis Toolkit (“new” analytic techniques relevant to military operations research), Military Operations Research Society, Kossiakoff Center, Johns Hopkins University Applied Physics Laboratory, Laurel, MD, 3 days, 20-22 February 2007.

Professional Society Officer Positions

Advances in Military Operations Research, Working Group Chair, Military Operations Research Society (MORS); *75th MORS Symposium, United States Naval Academy, Annapolis, MD.12-13 June 2007.*

Army and R&D Representative to Gaming Special Committee for *Interservice/Industry Training, Simulation and Education Conference (I/ITSEC)*, 2006-2007.

Army Representative to Research and Development (R&D) Committee *Interservice/Industry Training, Simulation and Education Conference (I/ITSEC)*, 2006-2007.

Chair, Academic Research Council, United States Military Academy, March 2006 to May 2007.

Session Chair (Research at USMA Addressing Department of Defense Strategic and Operational Needs) in Military Applications Cluster, Institute for Operations Research and Management Sciences (INFORMS); *2006 INFORMS Annual Meeting*, Pittsburgh, PA. 06-09 November 2005.

Number of Refereed Journal Publications Reviewed

Rowland, D. and L.R. Speight. “Surveying the Spectrum of Human Behavior in Front Line Combat”, to be published in *Military Operations Research*, 2007.

Yilmaz, Levent. “Reasoning about Conceptual Interoperability of Simulations Using Meta-level Graph Relations”, to be published in *International Journal of Simulation: Systems, Science & Technology*, 2007.

“Validating a Crowd Behavior Model”, to be published in *Simulation & Gaming*, 2007.

Number of Refereed Conference Proceedings Publications you reviewed

“Using Ontologies to Harmonize Data Models Among Communities of Interest (cOIs)”,
10th World Multi-Conference on Systemics, Cybernetics and Informatics
(WMSCI), Orlando, FL. 16-19 July 2006.

“iFEDaVis: interactive Finite Elements Data Visualization”, *IEEE VR 2007: Virtual Reality Conference*, Charlotte, North Carolina, USA, 14-17 March 2007.

“STORM: a generic interaction and behavioral model for 3D objects in a virtual environment, *IEEE VR 2007: Virtual Reality Conference*, Charlotte, North Carolina, USA, 14-17 March 2007.

McDonald, Mark and Sankaran Mahadevan, "System-of-Systems Modeling and Optimization Under Uncertainty for Effects-Based Operations", RMCI 2007: The 4th International Symposium on Risk Management and Cyber-Informatics, Orlando, Florida, USA. 08-11 Jul 2007.

38 Papers for R&D Committee, I/ITSEC 2006

10 Abstracts for R&D Committee, I/ITSEC 2007

Lei, Y.n, Song, L., Wang, W., and Jiang, C. “A Metamodel-based Representation Method for Reusable Simulation Model”, *Winter Simulation Conference 2007* (WSC '07), Washington, D.C., 9-12 December 2007.

Richmond, Paul W., Curtis L. Blais, Joyce A. Nagle, Niki C. Goerger, Burhman Q. Gates, Robin K. Burk, John Willis, and Robert Keeter, “Standards for the Mobility Common Operational Picture (M-COP): Elements of Ground Vehicle Maneuver”, ERDC TR-07-X, Engineer Research and Development Center, April 2007.

Santos, Isabel, and Santos, Pedro R. “Simulation Metamodels for Modeling Output Distribution Parameters”, *Winter Simulation Conference 2007* (WSC '07), Washington, D.C., 9-12 December 2007.

GRIFFIN, GREGORY C., MS, MAJOR

Non-Refereed Conference Presentations

“Using Agent Based Models to Assess Strategies Against Asymmetric Warfare” coauthored with Dr. Niki Goerger, LTC Simon Goerger, MAJ Paul Evangelista, and Dr. Paul Richmond, presented at INFORMS Annual Symposium, November, 2006.

“Using Agent Based Models to Assess Vehicle Borne Improvised Explosive Device Strategies” coauthored with Dr. Niki Goerger, LTC Simon Goerger, MAJ Paul Evangelista, and Dr. Paul Richmond, presented at United States/Canadian Operations Research Conference, Nova Scotia, CA, September 2006.

“Insights into Insurgent Decisioning and Response to Traffic Flow Strategies” coauthored with Dr. Niki Goerger, LTC Simon Goerger, MAJ Paul Evangelista, and Dr. Paul Richmond, paper published and presented at SISO Simulation Interoperability Workshop, September 2006.

Conference Presentations (Presented by not Authored)

"Setting the Stage for Battle Command Dominance: A Simulation-Based Methodology for Assessing the Capabilities of Future Battle Command Training Centers"; MAJ Gregory L. Boylan and LTC Simon R. Goerger, Simulation Interoperability Workshop, Orlando, Florida, September 2006.

Client Presentations

“A Case Study of the Army Rapid Fielding Initiative” coauthored with MAJ Scott Crino and LTC Dan McCarthy, PEO Soldier, Fort Belvoir, Virginia, 16 May 2007.

“SVBIED Detection and Defeat” ERDC Basic Research Review, coauthored with Dr. Niki Goerger, May 2007.

HALSTEAD, JOHN B., PhD, LIEUTENANT COLONEL

Awards

Finalist for the 2006 Barchi prize in Operations Research, *Support Vector Feature Selection with an application to classifying Army DEP Losses*

Refereed Journal Publications

IEEE, Computational Intelligence, *Recruiter Selection Model*, accepted pending minor edits

MORS, *Support Vector Feature Selection with an application to classifying Army DEP Losses*

Refereed Conference Proceedings Publications

IEEE SIEDS, *Army Opportunities Communication Model*

ASEM, *Army Opportunities Communication Model with Scenario Examples*

Refereed Conference Presentations

IEEE SIEDS, *Army Opportunities Communication Model*

ASEM, *Army Opportunities Communication Model with Scenario Examples*

Non-Refereed Conference Presentations

INFORMS, *Recruiter Selection Model*

Joint Accessions Research and Best Practices Symposium, *Recruiter Selection Model*

Client Presentations

Commanding General, Human Resources Command, *Recruiter Selection Model*

Commanding General, United States Army Recruiting Command, *Recruiter Selection Model*

Commanding General, United States Army Recruiting Command, *Army Opportunities Communication Model*

Center for Accessions Research (G2), United States Army Accessions Command, *Army Opportunities Communication Model*

G2, United States Army Recruiting Command, *Army Opportunities Communication Model*

HENDERSON, DALE L., PhD, LIEUTENANT COLONEL

Awards

Phi Kappa Phi, Scholastic Achievement Award, Instructor and Assistant Professor Category, 2007

Omega Rho International Honor Society, Operations Research and Management Science

Alpha Pi Mu, National Industrial Engineering Society

Books or Book Chapters

Parnell, G., Driscoll, P., and Henderson, D., ed's, "*Decision Making in Systems Engineering and Engineering Management*," Wiley Intersciences Series in Systems Engineering, Wiley 2007.

Refereed Journal Publications

Smith, C., Ortega, A., Henderson, D., DeVoe, J., "*A parameter optimization heuristic for a temperature estimation model*," Optimization and Engineering, Kluwer, 2007.

Non-Refereed Publications

Henderson, Dale L., Wong, E., "*The Armed Forces Casualty Assistance Readiness Enhancement System (AF CARES) Version 1.0*," ORCEN Technical Report, 2006.

Non-Refereed Conference Presentations

Henderson, D., Henderson, S., 74th MORS Presentation: "Social Network Analysis in Counterinsurgency", 74th MORS 2006.

Client Presentations

PEO Soldier Budget Model (x3)

Casualty and Mortuary Affairs Operations Center, Army HRC and Assistance Centers (x10)

JIEDDO Case Studies Working Group (x5)

Number of Refereed Journal Publications Reviewed:

(1) International Journal for Numerical Methods in Engineering

Number of Refereed Conference Proceedings Publications you reviewed

(16) Simulation Interoperability Standards Organization, Spring 2007 SIW.

(15) Simulation Interoperability Standards Organization, 2007 Euro-SIW.

Professional Committee Representations

Military Co-Chair, Army Basic Research Review, Robotics and Unmanned Systems Panel.

JAGMIN, CHAD, MS, MSE, MAJOR

Refereed Journal Publications

Awaiting acceptance: T. Jacobs, C. Jagmin, W. Williamson, Z. Filipi, D. Assanis, W. Bryznik, “Performance and Emission Enhancements of a Variable Geometry Turbocharger on a Heavy-Duty Diesel Engine” for consideration in the International Journal of Heavy Vehicle Systems' Special Issue on Performance and Dynamics of Multi-Wheeled and Tracked Military Vehicles.

KEWLEY, ROBERT H., PhD, LIEUTENANT COLONEL

Books or Book Chapters

Driscoll, Parnell, and Henderson (eds.); *Decision Making in Systems Engineering and Engineering Management*; Wiley Intersciences Series in Systems Engineering, 2007.

Refereed Conference Proceedings Publications

Kewley, Robert H., Paul Richmond, and Niki Goerger. "Co-Adaptive Behavior Algorithms for Insurgent and Counter-Insurgent Techniques in Combat Simulations." Proceedings of the 1st Annual IEEE Systems Conference, April 2007.

Kewley, Robert H. and Tim Elkins. "Teaching Command and Control Systems at the United States Military Academy." Proceedings of the 12th International Command and Control Research and Technology Symposium, June 2007.

Refereed Conference Presentations

Kewley, Robert H., Paul Evangelista, Mike Hendricks, Steve Riese, Paul West, and Mark Embrechts. "Data Mining Methods for Geospatial Threat Templating." 74th Military Operations Research Society Symposium, Colorado Springs, CO, June 2006.

Kewley, Robert H., Jillian Morton, Anthony Nguyen, Patricia Williams, and Leo Thomas. "Base Defense Planning and Employment Guidelines Using Data Farming and Agent Based Simulation." 74th Military Operations Research Society Symposium, Colorado Springs, CO, June 2006.

Kewley, Robert H., Paul Richmond, and Niki Goerger. "Co-Adaptive Behavior Algorithms for Insurgent and Counter-Insurgent Techniques in Combat Simulations." 1st Annual IEEE Systems Conference, Waikiki, HI, April 2007.

Kewley, Robert H. and Tim Elkins. "Teaching Command and Control Systems at the United States Military Academy." 12th International Command and Control Research and Technology Symposium, Newport, RI, June 2007.

Non-Refereed Conference Presentations

Kewley, Robert H., Ryan Keogh, Dan Palmer, Jason Keller, and Mike Staples. "Integrated Base Defense System: Designing a Cerberus Manual for Forward Operating Bases." 1st Annual Virginia Modeling, Analysis and Simulation Center Student Capstone Conference, Norfolk, VA, April 2007.

Kewley, Robert H., Eugene Page, Christopher Grevious, Guillermo Guandique, Michael Chun, Aaron Fairman, Grace Garcia, Daniel Pate, and Collin Smith. "Tactical Command and Control Data Requirements." 1st Annual Virginia Modeling, Analysis and Simulation Center Student Capstone Conference, Norfolk, VA, April 2007.

Non-Refereed Conference Proceedings Publications

Kewley, Robert H., Ryan Keogh, Dan Palmer, Jason Keller, and Mike Staples. "Integrated Base Defense System: Designing a Cerberus Manual for Forward Operating Bases." Proceedings of the 1st Annual Virginia Modeling, Analysis and Simulation Center Student Capstone Conference, April 2007.

Kewley, Robert H., Eugene Page, Christopher Grevious, Guillermo Guandique, Michael Chun, Aaron Fairman, Grace Garcia, Daniel Pate, and Collin Smith. "Tactical Command and Control Data Requirements." Proceedings of the 1st Annual Virginia Modeling, Analysis and Simulation Center Student Capstone Conference, April 2007.

Professional Society Officer Positions

Chair of Education Society for Mid-Hudson Chapter of Institute for Electrical and Electronics Engineers.

Number of Refereed Conference Proceedings Publications you reviewed:

- (2) 2007 Agent Directed Simulation Conference
- (2) 2007 Summer Computer Simulation Conference
- (1) 2007 Winter Simulation Conference

Professional Committee Representations

Working group chair for Combat Analyst Development, Education, and Tools working group for Military Operations Research Society Workshop "Warrior Analysts: How can we be Better Combat Multipliers?"

KORYCINSKI DONNA, PhD, LIEUTENANT COLONEL

Promoted to USMA Assistant Professor on 6 October 2006

Non-Refereed Publications

Korycinski, Donna K. "The Implementation of Lean Six Sigma Methodologies into Standard Army Practices," *U.S. Army War College Program Research Paper*, Carlisle Barracks, PA, 9 May 2007.

KRAMLICH, GARY, MS, MAJOR

Refereed Journal Publications

Kramlich, G. R. Kramlich G., Kobylski, G. C, & Ahner D. “Modeling Truck Camper Production,” *International Journal of Math Education in Science and Technology*. Accepted for publication, May 15, 2007.

Non-Refereed Conference Presentations

Predicting Remaining Effective Life in Small Arm Weapons. *INFORMS Annual Meeting 2006. Pittsburgh, PA*. 07 November 2006.

Predicting Remaining Effective Life in Small Arms Weapons. *2007 Decision and Risk Analysis Conference, University of Texas at Dallas*. 21 November 2007.

Client Presentations

Predicting Remaining Effective Life in Small Arms Weapons. Program Manager Soldier Weapons, Picatinny Arsenal, NJ. August & November 2006, and March & May 2007.

PEO Soldier Simulation Roadmap III: Initial Working Federation. PEO Soldier, Fort Belvoir, VA, 17 May 2007.

Number of Refereed Journal Publications Reviewed: 1

Injecting Realistic Human Models into the Optical Display of a Future Land Warrior System for Embedded Training Purposes. *Journal of Defense Modeling and Simulation*. JDMS-2006-06-0015.R3

KWINN, MICHAEL J., JR. PhD, LIEUTENANT COLONEL

Awards

Kenneth R. Wolff Award, presented by the Hudson Valley Chapter of Make-a-Wish.
Presented for the “Individual of the Year” for the chapter.

Books or Book Chapters

Kwinn, M. J. and Parnell, G., “Decision Making,” in *Systems Decision Making in Systems Engineering and Management*, ed. Gregory Parnell, Patrick Driscoll and Dale Henderson, Wiley Custom Services, Spring 2007.

K. Wormer, A. Hall, M. J. Kwinn, T. Shriver and D. Cashman, “Manpower and Personnel,” *Best Practices in Operational Analysis*, ed. Larry Rainey and Andy Loerch, to be published June 2007.

Refereed Journal Publications

Tollefson, E. S., G. L. Boylan, M. J. Kwinn and R. Guckert, “A Systems Engineering Approach to Determining Simulation Requirements for the Acquisition of Infantry Soldier Tactical Mission Systems,” *Systems Engineering*, Fall 2007, pp. 199-212.

Tollefson, E. S., G. L. Boylan, and M. J. Kwinn, “Using Systems Engineering to Provide Decision Support for the Acquisition of Infantry Soldier Systems,” accepted for publication in *Military Operations Research Journal*, May 2007.

Brockett, P. L., W.W. Cooper, L. Golden, S.C. Kubhakar, M.J. Kwinn and B. Layton “Estimating Elasticities with Frontier and Other Regressions for Use in Evaluating Alternative Advertising Strategies for Military Recruitment,” accepted for publication in *Socio-Economic Planning Sciences*, April 2007.

Brence, J., Kwinn, M. J., and Thomas, D., “Qualitative and Quantitative Analysis for US Army Recruiting Input Allocation”, accepted for publication in the *Military Operations Research Journal*, July 2006.

Refereed Conference Presentations

Kwinn, M. J., “Use of Decision Analysis and Operations Research in Support of Combat Operations,” INFORMS Conference on OR Practice, Vancouver, British Columbia, April 2007.

Refereed Conference Proceedings Publications

Kwinn, M.J., Gauthier S.E., and M.R. Weisner, “Implementing a Quantitative Assessment for the National Security Strategy”, Presentation and paper for the Cornwallis XII, Pearson Peacekeeping Institute, Clementsport, Nova Scotia, Canada; 2 April 2007.

Carier, Julia D., Earnest D. Smith, Andrew M. Wade, Paul S. Walker and Michael J. Kwinn, Jr., “Small Unit Unmanned Weapon System For Today’s Army”, *Proceedings for the Systems and Industrial Engineering Design Symposium*, April 2007.

Brown, Scott, Jeffery Cho, Nicholas Hill, Nathan Collier and Michael J. Kwinn, Jr., “A Systems Engineering Analysis of the USMA Systems Engineering Program,” *Proceedings for the 1st Annual IEEE Systems Conference*, April 2007.

Non-Refereed Publications

Kwinn, M. J., and Gauthier, Steve, “MORS Workshop: Warrior Analysts: How Can We Be Better Combat Multipliers?” *Phalanx*, June 2007.

Non-Refereed Conference Presentations

Kwinn, M. J., “Workshop Summary: Warrior Analysts: How Can We Be Better Combat Multipliers?” presentation to the Military Operations Research Society Symposium, 75th MORS, Annapolis, Maryland, June 2007.

Client Presentations

Carier, Julia D., Earnest D. Smith, Andrew M. Wade, Paul S. Walker and Michael J. Kwinn, Jr., “Small Unit Unmanned Weapon System For Today’s Army”, presentation to the Program Executive Officer – Aviation, April 2007.

Professional Society Officer Positions

Vice President, Phi Kappa Phi, West Point Chapter, July 2006-June 2007

Vice President (Professional Affairs), Military Operations Research Society, June 2006-June 2007.

Number of Refereed Journal Publications Reviewed:

(4) Military Operations Research Journal

Professional Committee Representations

Academic Excellence Committee, US Military Academy, West Point, NY, August 2006-June 2007.

ABET Committee, US Military Academy, West Point, NY, August 2006 - June 2007

LINDBERG, TRAVIS (TJ) J., MS, MAJOR

Refereed Journal Publications

Trainor, Timothy, Donna Brazil and Travis Lindberg, "Building Knowledge from Organizational Experience: Approaches and Lessons Learned from US Army Base Camp Workshops," Submitted November 2006 and pending approval by Engineering Management Journal

Lindberg, Travis and Timothy Trainor, "Enabling Knowledge Management of Base Camps for the Military," Proceedings of the 27th Annual Conference, American Society for Engineering Management (October 2006), pp. 101-107.

Lindberg, Travis, "Prioritization of Critical Infrastructure," Presentation conducted in the "General Engineering in Support of Stability Operations" breakout session in conjunction with the 2007 Engineer Regimental Training Conference in St. Louis, MO, 22 May 2007.

MARTIN, GRANT, MS, MAJOR

Number of Refereed Journal Publications Reviewed: 1

Martin, P. G., reviewed "Integrated Vendor-Buyer Cooperative Inventory Models with Variant Permissible Delay in Payments," by Professor Liang-Hsuan Chen, in the European Journal of Operational Research, September 2006.

McCARTHY, DANIEL, PhD LIEUTENANT COLONEL

Awards

Alpha Pi Mu Honor Society, inducted 19 March 2007

Order of the Engineer, West Point Link, inducted 27 March 2007

Refereed Conference Proceedings Publications

Crino, S., McCarthy, D. and Carier, J. 2007. Lean six Sigma for the Army Rapid Fielding Initiative. *Proceedings from the First Annual International Systems Conference*, Honolulu, HI, April.

Refereed Conference Presentations

Crino, S., McCarthy, D. and Carier, J. 2007. Lean six Sigma for the Army Rapid Fielding Initiative. *Proceedings from the First Annual International Systems Conference*, Honolulu, HI, April.

Client Presentations

McCarthy, D. and Griffin, G., “Army Rapid Fielding Initiative,” Fielding Event visit to Fort Bragg, NC, 17 January 2007

McCarthy, D. and Griffin, G., “Army Rapid Fielding Initiative,” PEO-Soldier/ RFI visit to Fort Belvoir, VA, 30-31 January 2007.

McCarthy, D. and Griffin, G., “Army Rapid Fielding Initiative,” Warehouse site visit in Middle River, MD, 31 January 2007.

Crino, S. McCarthy, D. and Griffin, G., “Army Rapid Fielding Initiative Business Case Study,” Final project report to the special assistant for the Rapid Fielding Initiative, PEO-Soldier, Fort Belvoir, VA, 16 May 2007.

Professional Society Officer Positions

Faculty Advisor, West Point Chapter of Alpha Pi Mu Honor Society, June 2007

MILLER, KENT, MS, COLONEL

Non-Refereed Publications

Phalanx review of *Statistical methods in counterterrorism : game theory, modeling, syndromic surveillance, and biometric authentication*; Wilson, Alyson G.; Wilson, Gregory D.; Olwell, David H.; New York, Springer, 2006, 280 pages.

Risk Analysis in Military Operations thesis US Army War College

Client Presentations

Physical Readiness Testing for the US Army Physical Fitness School, Fort Benning, GA
Improving ASIS for the Studies & Analysis Division, ARCIC, TRADOC

PARNELL, GREGORY S., PhD

Books or Book Chapters

Parnell, G. S., Driscoll, P. J., and Henderson D. L., Editors, **Decision Making for Systems Engineering and Management**, Spring 2007 Edition, Printed by Wiley & Sons Inc., 2007

Parnell, G. S., *Chapter 19, Value-Focused Thinking Using Multiple Objective Decision Analysis, Methods for Conducting Military Operational Analysis: Best Practices in Use Throughout the Department of Defense*, Military Operations Research Society, Editors Larry Rainey and Andrew Loerch, Forthcoming 2007

Refereed Publications

Dillon-Merrill, R. L., Parnell, G. S., Buckshaw, D. L., Hensley, W. R., Jr., Caswell, D. J., "Avoiding Common Pitfalls in Decision Support Frameworks for Department of Defense Analyses," Military Operations Research, accept November 2006, awaiting publication

Trainor, T., Parnell, G., Kwinn, B., Brence, J and Tollefson, E., Downes, P., "Decision Analysis Aids Regional Organization Design", *Interfaces*, accepted November 2005, awaiting publication

Refereed Conference Presentations

Trainor, T. and Parnell, G., "Using Stakeholder Analysis to Define the Problem in Systems Engineering," Proceedings of the International Conference, International Committee on Systems Engineering, San Diego, CA, June 24-28, 2007

Refereed Conference Proceedings Publications

Trainor, T. and Parnell, G., "Using Stakeholder Analysis to Define the Problem in Systems Engineering," Proceedings of the International Conference, International Committee on Systems Engineering, San Diego, CA, June 24-28, 2007

Non-Refereed Publications

Ewing, P. L., Tarantino, W., Dell, R., and Parnell, G. S., "Army BRAC 2005: Analysis Transformation," Phalanx, June 2006

Non-Refereed Conference Presentations

Parnell, G. S., "Decision Analysis for Systems Engineering," Military Operations Research Society Symposium, U.S. Air Force Academy, Colorado Springs, CO, 14 June 2006

Parnell, G. S., "Decision Analysis: The Science of Better (Decisions)", Methodologies for Allocation of Resources Conference, September 15, 2006, Berlin, Germany

Parnell, G. S., “Decision Analysis for Systems Engineering and Management,” Institute for Operations Research and Management Science (INFORMS) Annual Meeting, Pittsburgh, PA, November 6, 2006

Parnell, G. S. and Ezell, B. C., “Net-centric Risk Analysis,” Society for Risk Analysis Annual Meeting, Baltimore, MD, December 4, 2006

Client Presentations

Technology Assessment, AMRDEC, October 2006 and May 2007

Capability Assessment, AMRDEC, October 2006 and May 2007

Tutorials delivered

Parnell, G. and Pohl E., Multiple Objective Decision Analysis for Systems Engineering, INCOSE International Meeting, Orlando, FL, July 11, 2006

Parnell, G. and Driscoll, P., Systems Decision Making, Military Operations Research Society (MORS) Tutorial Meeting, John Hopkins Applied Physics Laboratory, Laurel, MD, February 21, 2007

Professional Society Officer Positions

President, Decision Analysis Society, INFORMS, 2004-2006

Past President, Decision Analysis Society, INFORMS, 2006-2008

Professional Service Positions

Guest Editor, Military Operations Research Special Issue on Value-Focused Thinking, 2007

Associate Editor, INFORMS Decision Analysis, 2007–present

Military Operations Research (1)

Decision Analysis (2)

Risk Analysis (1)

Systems Engineering (2)

Professional Committee Representations

Chair, National Research Council Study on Methodological Improvements to the Department of Homeland Security’s Biological Agent Risk Analysis, 2006-2007

Member, Technology Panel of the National Security Agency Advisory Board, 2003-present

Member, Data Center Panel of National Security Agency Advisory Board, 2006-present

Member, Architecture Panel of National Security Agency Advisory Board, 2007-present

Member, Department of Homeland Security, Office of Science and Technology, Critical Infrastructure Protection Decision Support System, Technical Review Panel, 2006

Member, INFORMS Decision Analysis Journal Editor Search Committee, 2006

Member, Distinguished Review Board for the Air Force Institute of Technology’s Center for Operational Analysis, 2005 – present

Member, Decision Analysis Society Ramsey Medal Review Committee, 2006-2007

ROEDERER, RODNEY L., MS, LIEUTENANT COLONEL

Non-Refereed Publications

Wong, Ernest Y., Roederer, Rod, “Should the U.S. have attacked Iraq? Can Decision Theory Shed Light on Polarizing Debate?” *ORMS Today*, Vol. 33, No. 6, December 2006. Pages 42-45

Professional Society Officer Positions

Manpower and Personnel, Working Group Chair, Military Operations Research Society (MORS); 75th MORS Symposium, United States Naval Academy, Annapolis, MD.12-14 June 2007.

SPERLING, BRIAN K., PhD, LIEUTENANT COLONEL

Awards

Honorable Mention for Best Paper I/ITSEC 2006

2007 Walter W. Hollis Award at 2007 Capstone Conference, United States Military academy, West Point, N.Y., 4 May, 2006.

Refereed Conference Proceedings Publications (accepted for publication)

Brian K. Sperling and Amy Pritchett, Georgia Institute of Technology. “Information Distribution to Improve Team Performance in Military Helicopter Operations: An Experimental Study”, Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2006

Brian K. Sperling and Amy Pritchett, Georgia Institute of Technology. “Information Sharing During Team Navigation: An Experimental Study”, Human Factors and Ergonomics Society’s 50th annual meeting (HFES), 2006.

Non-Refereed Conference Presentations

Sperling, Bradwick, Brown, Yancey, Hung. “Portfolio Analysis of Improvements to the Army Casualty Assistance System” 2007 IEEE Systems and Information Engineering Design Symposium, University of Virginia, 27 April 2007.

Sperling, Brian, Hwang, Peter, Domme, Sarah, Kim, Philip , Wang, Matthew. “A Value Focused Approach to Identifying the Top Hazards in Army Ground Vehicle Operations” Society Symposium (MORSS), US Air Force Academy, Colorado Springs, CO, 13-15 June 2006.

Non-Refereed Conference Proceedings Publications

Sperling, Bradwick, Brown, Yancey, Hung. “Portfolio Analysis of Improvements to the Army Casualty Assistance System” 2007 IEEE Systems and Information Engineering Design Symposium, University of Virginia, 27 April 2007.

Client Presentations

Initial Client Meetings – 1 (Human Resources Command)

In-Progress Reviews – 3 (Human Resources Command)

Final Briefings – 1 (Human Resources Command)

Professional Society Officer Positions

Decision Analysis, Working Group Co-Chair, Military Operations Research Society (MORS); 75th MORS Symposium, United States Naval Academy, Annapolis, MA.12-14 June 2007.

Army Representative to Simulation Committee for Interservice/Industry Training,
Simulation and Education Conference (I/ITSEC), 2007.

Treasurer/Secretary, INFORMS Military Applications Society, AY 2007.

Number of Refereed Journal Publications Reviewed: 3

TEAGUE, ED, MS, MAJOR

Number of Refereed Conference Proceedings Publications you reviewed: 2

TRAINOR, TIMOTHY E., PhD, COLONEL

Awards

- Best Undergraduate Engineering Management Program in the Nation for 2006** – Selected by the American Society of Engineering Management while I was the EM Program Director.
- Meritorious Service Award for 2006** - for Service to the American Society of Engineering Management.
- Military Family Volunteer of the Year Award** - for Service to the West Point Community in 2006.

Books or Book Chapters

- West, Paul D. and **Timothy E. Trainor** (2007). Risk-Based Decision Support of Water Resource Management Alternatives (Chapter 15). *Wastewater Reuse – Risk Assessment, Decision-Making and Environmental Security*, NATO Science for Peace and Security Series, Series C: Environmental Security. Springer Science and Business Media, Dordrecht, Netherlands. Available July 4, 2007.
- Trainor, Timothy E.**, and Gregory Parnell (2006). Chapter 9: Problem Definition, *Systems Decision Making in Systems Engineering and Management*. John Wiley & Sons, Inc., Hoboken, New Jersey. Accepted for publication December 2006.

Refereed Journal Publications

- Trainor, Timothy E.**, Donna Brazil and Travis J. Lindberg, Building Knowledge from Organizational Experience: Approaches and Lessons Learned from US Army Base Camp Workshops, submitted to the *Engineering Management Journal*, Dec 2006. (waiting reviewer comments)

Refereed Conference Proceedings Publications

- Trainor, Timothy E.**, and Gregory Parnell (2006). Using Stakeholder Analysis to Define the Problem in Systems Engineering. National conference of the International Council on Systems Engineering (INCOSE), June 2007.
- Lindberg, Travis, and **Timothy E. Trainor** (2006). Developing Base Camps to Support Military Operations Worldwide. *Proceedings of the 26th National Conference of the American Society for Engineering Management (ASEM)*. Norfolk, Virginia, October 26-29, 2005.

Non-Refereed Publications

- Trainor, Timothy E.**, Lehmkuhl, Lee, Dell, Robert, Huo, Chien and Wallshein, Corinne (2007). MORS Special Meeting: Analyzing the Value of Infrastructure, *Phalanx, The Bulletin of Military Operations Research*, Vol. 40, No. 1, March 2007.

Wong, Ernest, Jason Wolter and **Timothy Trainor**. (2006). *Undergraduate Faculty Development – Systems Engineering and the West Point Way*. Proceedings of the 2007 Hawaii International Conference on Education.

Workshops Run

Trainor, Timothy, Chien Huo and Corrine Wallshein. Technical Program Chairs for a workshop on the “Value of Infrastructure” sponsored by the Military Operations Research Society (MORS) for key analysts and decision makers in the DoD infrastructure analysis community. Workshop was held 14-16 November 2006 at Carlisle Barracks, Pennsylvania.

WEST, PAUL, PhD

Books or Book Chapters

West, Paul D., Trainor, Timothy, “Risk-Based Decision Support of Water Resource Management Alternatives,” *Wastewater Reuse – Risk Assessment and Decision-Making and Environmental Security*, NATO Security through Science, Series C – Environmental Security, Springer Science and Business Media, Dordrecht, Netherlands. ISBN 978-1-4020-6026-7, pp 145-156, © 2007.

West, Paul D., Kobza, John E., Goerger, Simon, “Systems Modeling and Analysis,” in *Decision Making in Systems Engineering and Management*, Parnell, Driscoll, Henderson, eds., John Wiley and Sons, Inc., pp 43-80, 2006.

West, Paul D., “Solution Design,” in *Decision Making in Systems Engineering and Management*, Parnell, Driscoll, Henderson, eds., John Wiley and Sons, Inc., pp 253-288, 2006.

Parnell, Gregory S., West, Paul D., “Systems Decision Process Overview,” in *Decision Making in Systems Engineering and Management*, Parnell, Driscoll, Henderson, eds., John Wiley and Sons, Inc., pp 183-200, 2006.

Refereed Journal Publications

West, Paul D., Verma, Dinesh, Farr, John V., Merino, Donald N., “A Taxonomy of Risk for Network-Centric Systems,” *Systems Engineering, Journal of the International Council on Systems Engineering* (Manuscript under revision).

Refereed Conference Proceedings Publications

West, Paul D., Edwards, Dennis J., Grodevant, Nicholas W., Lee, Phillip J., Peralta, James B., “DNA-MAN: Dynamic Natural Attributes for Synthetic Military Forces,” 2007 IEEE Systems and Information Engineering Design Symposium, Charlottesville, Virginia, April 2007.

Non-Refereed Publications

West, Paul D., Trainor, Timothy, “Risk-Based Decision Support of Water Resource Management Alternatives,” Technical Report DSE-TR -071, DTIC Report ADA 458328, Operations Research Center of Excellence, U.S. Military Academy, West Point, New York, December 2006.

WILLIS, JOHN, MS, LIEUTENANT COLONEL

Awards

Alpha Pi Mu Industrial Engineering Honor Society Inductee, 19 March 2007

Non-Refereed Conference Presentations

Willis, John B., “Quick Turn-Around Analysis for the US Army’s Rapid Equipping Force”, presented at the 2007 Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting, Pittsburgh, PA, 5-9 October 2006.

Willis, John B., “Automatic Identification Technology for Arms Room Management”, accepted for presentation at the Military Operations Research Society (MORS) Symposium, Annapolis, MD, 11-14 June 2007.

Professional Society Officer Positions

Chief Editor, *PHALANX – The Bulletin of Military Operations Research*, MORS

Professional Committee Representations

Executive Committee Member, Urban Operations Focus Area Collaborative Team

Member, Analysis Planning and Review Panel, Simulation Interoperability Standards Organization (SISO)

WONG, ERNEST Y., MS, MA, MAJOR

Awards

Phi Kappa Phi West Point Chapter Scholarship Award for Armed Forces Casualty Assistance Readiness Enhancement System, 2006-2007. Co-awarded with LTC Dale Henderson

Phi Kappa Phi National Honor Society 2007 Literacy Grant for Project MathWORKS! (West Point Operations Research Knowledge Society), April 2007-March 2008

National Aeronautics and Space Administration (NASA) Exploration Systems Summer Research Opportunity Faculty Fellowship, Marshall Space Flight Center, May-August 2006

Refereed Conference Proceedings Publications

Wong, Ernest. "Analyzing Whether the U.S. Should Have Attacked Iraq: A Decision Theory Primer," *Proceedings of the 65th Annual Midwest Political Science Association National Conference*, Chicago, IL, 12-15 April 2007.

Wong, Ernest, Jason Wolter, and Timothy Trainor. "Undergraduate Faculty Development—Systems Engineering and the West Point Way," *Proceedings of the 5th Annual Hawaii International Conference on Education*, Honolulu, HI, 6-9 January 2007.

Wong, Ernest, William Bland, and Simon Goerger. "The Armed Forces Casualty Assistance Readiness Enhancement System (CARES): A Case Study in Rapid Prototyping and Design for Flexibility," *Proceedings of the 40th Hawaii International Conference on System Sciences*, Big Island, HI, 3-6 January 2007.

Wong, Ernest, and Brigitte Kwinn. "Teaching Simulation to Non-Engineering Undergraduates: Systems Engineering and the West Point Way," *Proceedings of the 2006 Interservice Industry Training Simulation Education Conference*, 4-7 December 2006, Orlando, FL.

Wong, Ernest, Niki Goerger, Robert Keeter, and Simon Goerger. "Creating the Army Digital Terrain Catalog: A Case Study in Rapid Prototyping and Allowing Market Forces to Help Determine Standards," *Proceedings of the 2006 World Multiconference on Systemics, Cybernetics, and Informatics*, 17-19 July 2006, Orlando, FL.

Non-Refereed Publications

Willard, Quentin, Austin Bartlett, Louis Harrington, Jason McKay, and Ernest Wong. "A Systems Approach to Autonomous Space Exploration," *Proceedings of the 2007*

IEEE Systems and Information Engineering Design Symposium, 27 April 2007, Charlottesville, VA.

Harrington, Lou, Austin Bartlett, Quentin Willard, Jason McKay, Bruce Brown, and Ernest Wong. "Engineering Success & Successful Engineering: A West Point Cadet Project with NASA Illustrates the Value of Diversity," *Proceedings of the Spring 2007 Mid-Atlantic Region American Society for Engineering Education Conference*, 13-14 April 2007, Newark, NJ.

Wong, Ernest, and Rod Roederer. "Should the U.S. Have Attacked Iraq?" *ORMS Today Magazine*, Volume 33, No. 6, December 2006.

Wong, Ernest. "Going Beyond Simple Answers: Promoting Higher Order Thinking with Monte Carlo Simulation at West Point," *Proceedings of the 2006 Huntsville Simulation Conference*, 16-18 October 2006, Huntsville, AL.

Wong, Ernest. "Six-Sigma and Simulation: A Yin-Yang Approach to Better," *Phalanx: The Bulletin of Military Operations Research*, Vol. 39, No. 3, September 2006.

Refereed Conference Presentations

~~"Debating~~ Analyzing Whether the U.S. Should Have Attacked Iraq: A Decision Theory Primer." Presented at the 65th Annual Midwest Political Science Association National Conference, Chicago, IL, 12-15 April 2007.

"Undergraduate Faculty Development—Systems Engineering and the West Point Way." Presented at the 5th Annual Hawaii International Conference on Education, Honolulu, HI, 6-9 January 2007.

"The Armed Forces Casualty Assistance Readiness Enhancement System (CARES): A Case Study in Rapid Prototyping and Design for Flexibility." Presented at the 40th Hawaii International Conference on System Sciences, Big Island, HI, 3-6 January 2007.

"Teaching Simulation to Non-Engineering Undergraduates: Systems Engineering and the West Point Way." Presented at the 2006 Interservice Industry Training Simulation Education Conference, 4-7 December 2006, Orlando, FL.

"Creating the Army Digital Terrain Catalog: A Case Study in Rapid Prototyping and Allowing Market Forces to Help Determine Standards." Presented at the 2006 World Multiconference on Systemics, Cybernetics, and Informatics, 17-19 July 2006, Orlando, FL.

Non-Refereed Conference Presentations

"A Systems Approach to Autonomous Space Exploration." Presented at the 2007 IEEE Systems and Information Engineering Design Symposium, 27 April 2007, Charlottesville, VA. Co-authored with Quentin Willard, Austin Bartlett, Louis Harrington, and Jason McKay.

“Engineering Success & Successful Engineering: A West Point Cadet Project with NASA Illustrates the Value of Diversity.” Presented at the Spring 2007 Mid-Atlantic Region American Society for Engineering Education Conference, 13-14 April 2007, Newark, NJ. Co-authored with Lou Harrington, Austin Bartlett, Quentin Willard, Jason McKay, and Bruce Brown.

“A Systems Approach to Autonomous Space Exploration.” Presented at the 2007 Military Operations Research Society Education Colloquium, 4 April 2007, New London, CT. Co-authored with Austin Bartlett, Lou Harrington, Jason McKay, and Quentin Willard.

“Going Beyond Simple Answers: Promoting Higher Order Thinking with Monte Carlo Simulation at West Point.” Presented at the 2006 Huntsville Simulation Conference, 16-18 October 2006, Huntsville, AL.

“Six Sigma and Simulation: A Yin and Yang Approach towards the Pursuit of Better.” Presented at the 2006 Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, Pittsburgh, PA, 7 November 2006.

“Defining Meaningful Metrics for this New Century—A Condition-Based Maintenance Example.” Presented at the 2006 Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, Pittsburgh, PA, 7 November 2006. Co-authored with LTC Simon R. Goerger.

“CARES—A Tool that Enhances the Military’s Casualty Program.” Presented at the 2006 Institute of Industrial Engineers (IIE) & American Society for Quality (ASQ) Lean and Quality Conference and Expo, Atlanta, GA, 31 October 2006. Co-authored with LTC Simon R. Goerger and LTC Dale Henderson.

Tutorials Delivered

“Introducing @*RISK* to Undergraduates Attending West Point—Investing and Gambling for Active Learning.” Presented at the 2006 Palisade User Conference, 13-14 November 2006, Miami, FL.

Professional Society Officer Positions

Treasurer, West Point Chapter of the Phi Kappa Phi National Honor Society
President & Founder, West Point Operations Research Knowledge Society

Number of Refereed Conference Proceedings Publications you reviewed: 2

- (1) The 2007 American Society for Engineering Education National Conference.
- (1) The 2006 World Multi-conference on Systemics, Cybernetics, and Informatics.

Professional Committee Representations

Department of Systems Engineering Marketing and Communications Committee

PART VII - Distribution List

ORGANIZATION	ADDRESS	COPIES
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Technical Director Operational Test and Evaluation Command (OPTEC)	Park Center IV 4501 Ford Avenue, Suite 1420 Alexandria, VA 22302	1
Assistant Deputy Chief of Staff for Doctrine, HQ TRADOC	ADCS DOC ATTN:ATDO-ZA Ft. Monroe, VA 23651-5000	1
Director TRADOC Analysis Center (TRAC) – (Monterey)	PO BOX 8695 Monterey, CA 93943	1
Director TRADOC Analysis Command (TRAC) – (FLVN)	255 Sedgwick Ave. Ft. Leavenworth, KS 66027-5200	1
Director USA TRADOC Analysis Command – (WSMR)	Martin Luther King Drive, Bldg. 1400 White Sands Missile Range, NM 88002-5502	1
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US Army Training Support Center Training Support Assistance and Integration Directorate, Asst. Division	ATTN: ATIC-SAIA-AN Bldg #1529 Ft. Eustis, VA 23604	1
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Commander US Army Test & Evaluation Command	4501 Ford Avenue Alexandria, VA 22302-1458	1
Commander US Army Recruiting Command	ATTN: RCPAE Ft. Knox, KY 40121	1
Commander US Army Space & Missile Defense Command	1941 Jefferson Davis Highway -Suite 900 Arlington, VA 22215-0280	1
Director Army Research Laboratory	2800 Powder Mill Road Adelphi, MD 20783- 1145	1
Director ARL – Sensors & Electronic Devices Directorate	ATTN: AMSRL-SE-S 2800 Powder Mill Road Adelphi, MD 20783-1197	1
Director Center for Army Analysis	6001 Goethals Road Ft. Belvoir, VA 22060-5230	1
Director Information Systems for Command, Control, Communications & Computers	107 Army Pentagon Washington DC 20310-0107	1
Director Program Analysis & Evaluation, OCSA	200 Army Pentagon Washington, DC 20310-0200	1
Director Strategic Studies Institute	US Army War College Carlisle Barracks, PA 17013	1
Dean Naval Postgraduate School	1 University Circle Monterey, CA 93943	1
Dean Air Force Institute of Technology	2950 Hobson Way WPAFB OH 45433-7765	1
Dean Command & General Staff College	Ft. Leavenworth, KS	1
Director US Army Cost & Economic Analysis Center	1421 Jefferson Davis Highway - Suite 9000 Arlington, VA 22202	1
Director US Army Materiel Systems Analysis Activity	Aberdeen Proving Ground MD 21005-5071	1
Director US Army National Simulation Center	ATTN: ATZL-NSC 410 Kearney Avenue – Building 45 Ft. Leavenworth, KS 66027-1306	1
Director US Army Research Institute for Behavioral and Social Sciences	5001 Eisenhower Avenue Alexandria, VA 22333	1
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Commandant USAFAS	ATTN: ATSF-CBL Ft. Sill, OK 73503-5600	1
Commander USASC (Signal Center)	ATTN: ATZH-BL Ft. Gordon, GA 30905-5299	1
Commander USAIC&FH (Intel Center)	ATTN: ATZS-FDB Ft. Huachuca, AZ 85613-6000	1
Commander USACASCOM	ATTN: ATCL-B Ft. Lee, VA 23801-6000	1
HQ USAMANSCE Ft. Leonard Wood	ATTN: ATZT-MSBL Ft. Leonard Wood, MO 65473-6620	1
Commander USAAVNC	ATTN: ATZQ-ABL Ft. Rucker, AL 36362-5000	1
Commander USASMD	ATTN: SMD-CBL P.O. Box 1500 Huntsville, AL 35807-3801	1
Commander USARSPACE STRATEGIC COMMAND	ATTN: SMD-ARSTRAT 350 Vandenberg Street Colorado Springs, CO 80914	1
Commandant USAADASCH	ATTN: ATSA-CDB 5800 Carter Road Ft. Bliss, TX 79916-3802	1
Commander USATRADO	ATTN: ATCD-B Ft. Monroe, VA 23651-5000	1
Battle Command Ft. Leavenworth Commander USACAC	ATTN: ATXH-BLT Ft. Leavenworth, KS 66027- 5300	1
Depth & Simultaneous Attack Commandant USAFAS	ATTN: ATSF-CBL Ft. Sill, OK 73503-5600	1
Battle Command Ft. Gordon Commander USASC&FG	ATTN: ATZH-BLT Ft. Gordon, GA 30905-5294	1
Mounted Battle Space Commander USARMC	ATTN: ATZK-MW Ft. Knox, KY 40121-5000	1
Battle Command Ft. Huachuca Commander USAIC&FH	ATTN: ATZS-CDT Ft. Huachuca, AZ 85613-6000	1

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Dismounted Battle Space Commandant USAIS	ATTN: ATSH-IWC Ft. Benning, GA 31905-5007	1
Combat Service Support Commander USACASCOM	ATTN: ATCL-C Ft. Lee, VA 23801-6000	1
Early Entry Lethality and Survivability Commander USATRADO	ATTN: ATCD-L Ft. Monroe, VA 23651-5000	1
Battle Lab Integration & Technology Directorate Commander USATRADO	ATTN: ATCD-L Ft. Monroe, VA 23651-5000	1
Command General US Army Materiel Command (AMC)	AMCCG Bldg 1464 Fort Belvoir, VA 22060	1
Commander US Joint Forces Command	1562 Mitscher Ave. Suite 200 Norfolk, VA 23551	1
Deputy Chief of Staff for Personnel Army G-1	300 Army Pentagon Washington, DC 20310-0300	1
Deputy Chief of Staff Training & Leader Development Directorate Army G-3	300 Army Pentagon Washington, DC 20310-0300	1
Deputy Chief of Staff for Logistics Army G-4	300 Army Pentagon Washington, DC 20310-0300	1
Commander US Army Recruiting Command (USAREC)	ATTN: RCPAE 1307 Third Avenue Ft. Knox, KY 40121-2726	1
Commander US Army Accessions Command (USAAC)	90 Ingalls Road – Bldg. 100 Ft. Monroe, VA 23651	1
Director Defense Advanced Research Project Agency (DARPA)	3701 North Fairfax Drive Arlington, VA 22203-1714	2
Program Executive Officer (PEO) Soldier	5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	1
Director TACOM-ARDEC	AMSTA-AR-TD Bldg 1, 3rd Floor Picatinny Arsenal, NJ 07806-5000	1
Director Operational Test Command (OTC)	Aviation Test Directorate Ft Hood, TX 76544	1
Director Defense Modeling & Simulation Office	1901 N. Beauregard Street, Suite 500 Alexandria, VA, 22311-1705	1
Project Manager Unmanned Aerial Vehicles	PEO Aviation Redstone Arsenal, AL	1
Director HEL Joint Technology Office	901 University Boulevard SE – Suite 100 Albuquerque, NM 87106	1

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REPORT DOCUMENTATION PAGE			<i>Form Approved</i> <i>OMB No. 0704-0188</i>		
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1. REPORT DATE (DD-MM-YYYY) 01-22 2008		2. REPORT TYPE Annual Report		3. DATES COVERED (From – To) 07-2006 to 06-2007	
4. TITLE AND SUBTITLE ANNUAL REPORT OF THE OPERATIONS RESEARCH CENTER AND DEPARTMENT OF SYSTEMS ENGINEERING FOR ACADEMIC YEAR 2007			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) COLLABORATIVE EFFORT OF THE DEPARTMENT OF SYSTEMS ENGINEERING, ORGANIZED BY THE OPERATIONS RESEARCH CENTER			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Operations Research Center of Excellence Department of Systems Engineering US Military Academy Bldg.#752-Mahan Hall-Room 305 West Point, NY 10996			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution A - Approved for Public Release - Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The purpose of this document is to formally summarize and conclude the research program of the U.S. Military Academy Department of Systems Engineering (DSE) and the Operations Research Center for Excellence (ORCEN) for the Academic Year 2007. The annual research report includes a statement of purpose for research which supports DSE and the ORCEN, a description of the two organizations, a list of the key personnel responsible for executing the plan, and an overview of the annual research cycle.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT None	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON LTC Simon R. Goerger
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (include area code) 845-938-5529